

MAGNOLIACEAE HARDY IN TEMPERATE NORTH AMERICA¹

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MAGNOLIACEAE A. L. de Jussieu, Gen. Pl. 280. 1789, "Magnoliae," nom. cons.

(MAGNOLIA FAMILY)

Evergreen or deciduous trees or shrubs, the wood and bark often containing aromatic oils or mucilaginous substances; buds enclosed by stipular scales and the branchlets with conspicuous annular stipular scars at the nodes. Leaves conduplicate in bud, alternate, occasionally crowded into

¹This treatment of the Magnoliaceae is the third published contribution in a series of treatments of cultivated ligneous plants, the preparation of which is a project of the Arnold Arboretum of Harvard University and the purpose of which is to provide a modern, accurate account of the woody plants encountered in cultivation in the cooler temperate regions of North America. It is hoped that these treatments will eventually form the basis of a new manual of cultivated woody plants. The first paper in this series was published in the *Journal of the Arnold Arboretum* 56: 1-19. 1975. Reference should be made to the introductory paragraphs of that paper for matters concerning area covered, taxa included, and the general philosophy of these treatments.

On the one-hundredth anniversary of his birth, it is with pleasure and admiration that this treatment of the Magnoliaceae is dedicated to the memory of ERNEST HENRY WILSON (1876-1930), indefatigable plant hunter and late Keeper of the Arnold Arboretum. It was through Wilson's efforts that many of the most ornamental taxa of *Magnolia* were introduced into cultivation in western gardens, and our knowledge of the genus and family has been greatly augmented by the specimens and information he collected on his several expeditions to eastern Asia.

Many individuals have made generous contributions of their time, advice, and knowledge during the preparation of this treatment, and I should like to thank Drs. R. A. Howard, L. M. Perry, K. R. Robertson, B. G. Schubert, P. F. Stevens, C. E. Wood, Jr., and R. E. Weaver, Jr., Miss K. Clagett, and Mrs. I. H. Burch, all of the Arboretum staff, for their freely given help. Particular thanks are also extended to Dr. N. G. Miller for his contribution of unpublished information, his collaboration on the treatment of *Liriodendron*, and his alcohol-preserved collections from which the illustrations for that genus were prepared; to Mr. B. H. Tiffney for data concerning the seeds and fossil distribution of *Magnolia*; and to the curators of the herbaria at Kew, the United States National Arboretum, and the National Science Museum, Tokyo, for the loan of herbarium specimens. Numerous friends and colleagues have also given freely of their time and advice and have supplied information, and to them I am greatly indebted. They include Dr. T. R. Dudley, Dr. J. M. Fogg, Jr., Miss J. deN. Henry, Mrs. J. W. Hill, Mr. H. G. Hillier, Mr. C. R. Lancaster, Dr. E. McClintock, Dr. J. C. McDaniel, Mr. B. Mulligan, Mr. N. Treseder, and Mr. J. C. Williams; I also thank my wife, Harmony, for help in many ways.

The illustrations are the careful work of Robin S. Lefberg and were prepared, when possible, from living or alcohol-preserved specimens collected in the Arnold Arboretum. Additional specimens collected at the Arboretum of the Barnes Foundation, the Henry Foundation for Botanical Research, and the Strybing Arboretum have been utilized, and thanks are due Dr. R. Simmers for providing material of *Magnolia macrophylla* collected in Tennessee.

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false whorls, stipulate, the stipules free or adnate to and leaving scars on the adaxial surfaces of the petioles; leaf blades with pinnate venation, simple or lobed, the bases sometimes cordate to auriculate, the apices occasionally emarginate. Flowers solitary, terminal or axillary, perfect or rarely imperfect (*Kmeria*), in bud enclosed by one or more deciduous stipular bracts. Perianth of (5-)6-9-numerous, free, subsimilar or dimorphic tepals (in *Liriodendron* clearly differentiated into sepals and petals) in (2 or) 3 or sometimes more whorls, the tepals usually fleshy. Stamens numerous, spirally arranged on an elongate floral axis, 2-locular, the connectives often produced into short appendages, the anther sacs introrsely to extrorsely longitudinally dehiscent. Gynoecia comprised of numerous (rarely 1 or few) spirally arranged, free or basally concrescent, conduplicate carpels, the carpels usually closely imbricated on an elongate floral axis and contiguous with the androecium below (sessile) or separated from the androecium by a short gap on the floral axis (stipitate); carpels 2-6-ovulate, the ovules anatropous, bitegmic, crassinucellar. Fruits usually conelike aggregates of free or basally concrescent, dehiscent (or rarely indehiscent) follicles or conelike aggregates of deciduous samaras, rarely capsular. Seeds 1 or more per follicle or samara, the seed coat usually comprised of an outer, fleshy, aril-like layer and a hard, bony, inner layer, the small embryo embedded in copious oily endosperm. Base chromosome number = 19. (Tulipiferae Ventenat; including Liriodendraceae F. A. Barkley, excluding Illiciaceae Hu and Schisandraceae Blume.) TYPE GENUS: *Magnolia* L.

About twelve genera and 200 species in two tribes distributed in temperate and tropical eastern and southeastern Asia and in the Western Hemisphere in eastern North America from southern Canada southward through the West Indies and Central America to eastern Brazil; absent from Europe, Africa, Australasia, and Polynesia. Numerous species of several genera are of great importance as horticultural subjects, while other species are valued for their timber. Three genera are cultivated in our area, while species of *Manglietia* Blume (ca. 25 species of subtropical and tropical Asia) and *Talauma* Jussieu (ca. 40 species of subtropical and tropical Asia, southern Mexico, and the West Indies to Brazil) are occasionally cultivated south and west of our range in the United States. Because species of these two genera might be grown within our range in the collections of a few specialists, they are included in the key to the genera.

Owing to its position as one of the least derived and most ancient taxa of angiosperms, the Magnoliaceae has been the subject of considerable interest and numerous investigations, and a large body of literature concerning the biology of the family has accumulated. The references included in this paper are by no means all-inclusive but have been selected

addition, our deepest thanks are extended to the Director and trustees of the Stanley Smith Horticultural Trust for a grant that has made possible the preparation of illustrations to accompany these treatments. S. A. S.

to cover most aspects of the biology of the family and to include summary papers containing extensive bibliographies. In addition to the papers cited in the references, numerous articles of taxonomic importance or of limited specific content have been cited in the discussions of particular species. The discussions in Bean (1973) should be consulted for much historical and cultural information not included here.

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KEY TO THE GENERA OF MAGNOLIACEAE IN CULTIVATION

1. Fruits comprised of conelike aggregates of follicles, the follicles persistent on the floral axis; plants evergreen or deciduous, the leaves simple, not lobed, occasionally cordate to auriculate at base or emarginate at apex. Magnolieae. 2.
2. Flowers terminal; gynoecia sessile (or rarely short-stipitate in *Magnolia*); plants evergreen or deciduous. 3.
3. Mature follicles free, dehiscent along the abaxial sutures. 4.
4. Carpels with 2 ovules, the follicles with 2 seeds or sometimes 1 or none through abortion; plants evergreen or deciduous. 1. *Magnolia*.
4. Carpels with 4 or more ovules, the follicles with 4 or more seeds, sometimes fewer through abortion; plants evergreen. *Manglietia*.
3. Mature follicles free or basally concrescent, circumscissile, the upper portions falling away individually or in irregular clusters. *Talauma*.
2. Flowers axillary; gynoecia stipitate; plants evergreen. 2. *Michelia*.
1. Fruits comprised of conelike aggregates of closely imbricated, 2-seeded samaras, the samaras falling at maturity, leaving a persistent spindle-shaped floral axis; plants deciduous, the leaves variously lobed. Liriodendreae. 3. *Liriodendron*.

Tribe MAGNOLIEAE

1. *Magnolia* Linnaeus, Sp. Pl. 1: 535, 536. 1753;
Gen. Pl. ed. 5. 240. 1754.

Evergreen, deciduous, or sometimes partially evergreen trees or shrubs of sympodial growth; bark often smooth, lenticellate, or sometimes rough and deeply furrowed, often silvery- or pewter-gray, the branchlets with continuous or septate pith; winter buds of two types, vegetative and mixed, enclosed by stipular scales, the mixed buds terminal and the stipular scales enclosing a terminal flower primordium subtended by one or more internodes with axillary vegetative buds at the nodes. Leaves alternate, sometimes crowded into false whorls, petiolate, stipulate, the stipules caducous, either free from the petioles or adnate to and leaving scars on the adaxial surfaces of the petioles; leaf blades thickly coriaceous to membranaceous, entire, sometimes cordate to auriculate at base or emarginate at the apex. Flowers usually fragrant, often large and showy, protogynous, beetle-pollinated, terminal, solitary, appearing before the leaves in spring (precocious) or with the leaves; within the mixed buds the flowers enclosed by one or more deciduous stipular (spathaceous) bracts, each bract leaving an annular scar on the pedicel. Tepals (5–)6–9–numerous (up to ca. 33), white or pink to purple, occasionally greenish or clear yellow, in whorls of 3, occasionally more, subsimilar or sometimes the outer whorl reduced in size and calyxlike. Stamens numerous, deciduous after anthesis, poorly differentiated into filaments and connectives, the connectives often produced into an appendage at the apex, the anther sacs introrsely or laterally dehiscent. Gynoecia sessile or rarely short-stipitate, cylindric to subglobose, the carpels with 2 ovules, the styles recurved, with stigmatic papillae along their adaxial surfaces. Fruits subglobose to cylindric conelike aggregates of follicles, the aggregates often asymmetrical from follicle (seed) abortion, at maturity the follicles free from one another and longitudinally dehiscent along their abaxial sutures. Seeds 1 or 2, suspended on thin threads (the elongated vessel elements of the funiculi and placentae), the seed coats with an aril-like, orange, red, or pink outer layer and a hard, bony inner layer. (*Buergeria* Sieb. & Zucc.; *Lassonia* Buc'hoz; *Tulipastrum* Spach; *Yulania* Spach.) TYPE SPECIES: *M. virginiana* L. (Name commemorating Pierre Magnol, 1638–1715, professor of botany and medicine and one-time director of the botanical garden at Montpellier, France.) — MAGNOLIA.

Approximately 80 species in two subgenera and 11 sections distributed in regions of temperate to tropical climates of eastern Asia from Manchuria, Korea, and Japan southward through China and the eastern Himalayan region to Java in the Malay Archipelago, and in the Western Hemisphere from southern Canada southward through the eastern United States, the West Indies, Mexico, and Central America to southeastern Venezuela. Several species of temperate areas in Asia have not yet been introduced into western horticulture. All of those that have, as well as those

North American species that are hardy within our area, are highly desirable ornamentals, and the genus is one of the most important groups of ornamental woody plants.

In nature, each species of *Magnolia* appears to occupy an exclusive range or habitat, thus precluding natural hybridization between species, but in cultivation several interspecific hybrids, some of considerable ornamental value, have occurred spontaneously or have been produced intentionally. Moreover, the ease with which species hybridize has stimulated ambitious breeding programs undertaken by several horticulturists. Within subgenera there are few barriers to hybridization between taxa of the same or different sections; however, substantial barriers between subgenera undoubtedly exist, inasmuch as no hybrids between species of the two subgenera have been recorded.

Most species of *Magnolia* are variable, and a great number of individual plants of horticultural value have been designated as cultivars. Moreover, several of the important hybrids have not been given specific epithets but are known chiefly by cultivar names. Therefore, outstanding cultivars have been briefly described or mentioned below, particularly when they are widespread in gardens or represent a particular species or hybrid group in cultivation. No attempt has been made, however, to account for all the cultivars of a particular species or hybrid group. Persons interested in *Magnolia* cultivars are encouraged to consult the checklist of Fogg and McDaniel (1975), in which a nearly complete and current listing of all cultivars of *Magnolia* has been assembled.

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KEY TO THE SUBGENERA OF MAGNOLIA

1. Anthers dehiscing introrsely; flowers neither appearing before the leaves nor with an outer whorl of sepaloid tepals; plants evergreen or deciduous. Subg. MAGNOLIA.
1. Anthers dehiscing laterally or sublaterally; flowers precocious, appearing before the leaves and/or with a much reduced outer whorl of sepaloid tepals; plants deciduous. Subg. YULANIA (see p. 280).

MAGNOLIA subg. MAGNOLIA

Evergreen or deciduous trees and shrubs, the flowers appearing with the leaves; tepals subsimilar, the outer whorl like the inner whorls, never reduced in size and sepaloid; anther sacs introrsely dehiscent.

Eight sections, two of American distribution in both hemispheres, five of Asiatic distribution, and one with species in North America and eastern Asia; species of six of these sections represented in cultivation in our area.

KEY TO THE SPECIES AND SELECTED HYBRIDS OF MAGNOLIA SUBG. MAGNOLIA IN CULTIVATION

1. Stipules free, not adnate to and not leaving scars on the adaxial surfaces of the petioles; plants evergreen. 2.
2. Gynoecia sessile, the floral axis with stamens or stamen scars contiguous with the lowermost carpels or follicles. 3.
3. Tepals 7.5-12 cm. long; stamens 13-21 mm. long, yellowish; fruit aggregates ovoid, 5.5-7.5 cm. long. 1. *M. grandiflora*.
3. Tepals 5.5-9 cm. long; stamens ca. 12 mm. long, rosy-purple; fruit aggregates ca. 4 cm. long, rarely developed. 23. *M. virginiana* × *M. grandiflora*.
2. Gynoecia stipitate, the floral axis with stamens or stamen scars not contiguous with the lowermost carpels or follicles. 2. *M. nitida*.
1. Stipules adnate to the petioles, leaving scars on the adaxial surfaces of the petioles; plants evergreen or deciduous. 4.
4. Plants evergreen. 5.
5. Stipule scars large, extending almost the entire length of the petiole to the base of the leaf blade. 6.
6. Petioles (2.6-)3.5-6.7(-8.7) cm. long; leaf blades thickly coriaceous, the lower surfaces pale green or yellowish; fruit aggregates 6.7-9.5 cm. long. 3. *M. delavayi*.
6. Petioles 1.5-2(-3) cm. long; leaf blades thinly coriaceous to membranaceous, the lower surfaces glaucous, rarely green; fruit aggregates 2-5 cm. long. 4. *M. virginiana*.

5. Stipule scars very small, at the base of the petioles, often obscure. 23. *M. virginiana* × *M. grandiflora*.
4. Plants deciduous. 7.
7. Leaves crowded into false whorls at the ends of branchlets, distinctly alternate on new shoots; leaf blades large or very large, (10-)18-60(-100?) cm. long. 8.
8. Leaf blades cordate to auriculate at base. 9.
9. Lower surfaces of the leaf blades, stipules, carpels, and follicles pubescent. 10.
10. Trees; stamens 15-18 mm. long; fruit aggregates subglobose to globose. 5. *M. macrophylla* subsp. *macrophylla*.
10. Large shrubs; stamens 11-13 mm. long; fruit aggregates subcylindric to ovoid. 5. *M. macrophylla* subsp. *ashei*.
9. Lower surfaces of the leaf blades, stipules, carpels, and follicles glabrous. 11.
11. Stamens 8-15 mm. long; gynoecia ca. 2.5 cm. long at anthesis; fruit aggregates 6.5-11 cm. long. 6. *M. fraseri* var. *fraseri*.
11. Stamens 4-6 mm. long; gynoecia ca. 1.5 cm. long at anthesis; fruit aggregates 3.5-5.5(-6) cm. long. 6. *M. fraseri* var. *pyramidata*.
8. Leaf blades cuneate to rounded at base. 12.
12. Hairs on the lower surfaces of the leaf blades usually with rust-colored pigment; tepals broadly obovate, 5.5-6 cm. long; stamens rosy-crimson throughout. 24. *M.* × *wieseneri*.
12. Hairs on the lower surfaces of the leaf blades lacking rust-colored pigment; tepals obovate to oblong-elliptic or spatulate, 8-12 cm. long; stamen filaments tinged reddish, the anther sacs creamy white or yellowish. 13.
13. Flowers with an offensive odor; fruit aggregates 7-10 cm. long; small trees of open habit. 7. *M. tripetala*.
13. Flowers pleasantly fragrant; fruit aggregates (9-)13.5-20 cm. long; large, widely branching trees. 14.
14. Leaf blades mostly oblong-obovate, with acute to rounded apices; young branchlets purplish or silvery; fruit aggregates with the lowermost follicles concave, decurrent along the floral axis. 8. *M. hypoleuca*.
14. Leaf blades mostly elliptic-obovate, sometimes deeply emarginate at apex; young branchlets yellowish or yellowish-gray; fruit aggregates with the lowermost follicles convex, not decurrent along the floral axis. 9. *M. officinalis*.
7. Leaves distinctly alternate, not crowded into false whorls at the ends of branchlets; leaf blades of moderate size, not exceeding 23 cm. in length. 15.
15. Flowers and fruit aggregates held ± erect on the branchlets. 16.
16. Anthers yellowish, the connectives with short, acute appendages. 17.

- 17. Pith septate; tepals 6–15, 3–5(–9) cm. long; leaf blades (3.5–)6.5–10.5(–17.7) cm. long, generally narrowly oblong to elliptic or ovate. 4. *M. virginiana*.
- 17. Pith incompletely septate; tepals 9, 7–9 cm. long; leaf blades (5.5–)12–17.5(–22) cm. long, broadly elliptic to oblanceolate. 25. *M. × thompsoniana*.
- 16. Anthers rosy-crimson, rounded or blunt at the apices, the connectives only rarely produced into apiculate appendages. 24. *M. × wieseneri*.
- 15. Flowers and fruit aggregates held nodding or pendent on the branchlets. 18.
- 18. Branchlets becoming dark reddish- or purplish-brown. . . 19.
- 19. Leaf blades elliptic, broadly ovate, or usually obovate, (4.5–)7–9(–14.5) cm. wide, generally rufous-pubescent on the under surfaces; stamens 12–17 mm. long. 10. *M. globosa*.
- 19. Leaf blades elliptic or usually lanceolate to oblong-ovate, (2.5–)3–7(–11) cm. wide, generally yellowish- or silvery-pubescent on the under surfaces; stamens 9–12 mm. long. 11. *M. wilsonii*.
- 18. Branchlets becoming light brown or silvery-tan. 20.
- 20. Some or all hairs on the lower surfaces of the leaf blades with rust-colored pigment, the hairs $\pm$ straight; leaf blades usually broadly obovate. 12. *M. sieboldii* subsp. *sieboldii*.
- 20. Hairs on the lower surfaces of the leaf blades clear, lacking rust-colored pigment, the hairs $\pm$ crinkled; leaf blades usually broadly elliptic to obovate. 12. *M. sieboldii* subsp. *sinensis*.

MAGNOLIA sect. THEORHODON Spach, Hist. Nat. Veg. Phanerog. 7: 470. 1839.

Evergreen trees, variously pubescent; stipules free from the petioles; gynoecia sessile, the stamens and carpels contiguous on the floral axis. TYPE SPECIES: *M. grandiflora* L.

About fifteen species of the Americas; with the exception of *Magnolia grandiflora*, all of tropical distribution. Several species of sect. THEORHODON of tropical areas have been introduced into cultivation but are not known to be hardy within our region.

1. *M. grandiflora* Linnaeus, Syst. Nat. ed. 10. 2: 1082. 1759.

FIGURE 1.

Large, evergreen trees, often of pyramidal habit, sometimes attaining 25 or 30 m., the bark brown or gray, with thin, tightly appressed platelets; branchlets stout, with septate pith, at first densely felted with rufous, yellowish, or silvery hairs, the older growth eventually glabrous, becoming dark blackish-brown; buds densely sericeous with rufous to $\pm$ silvery

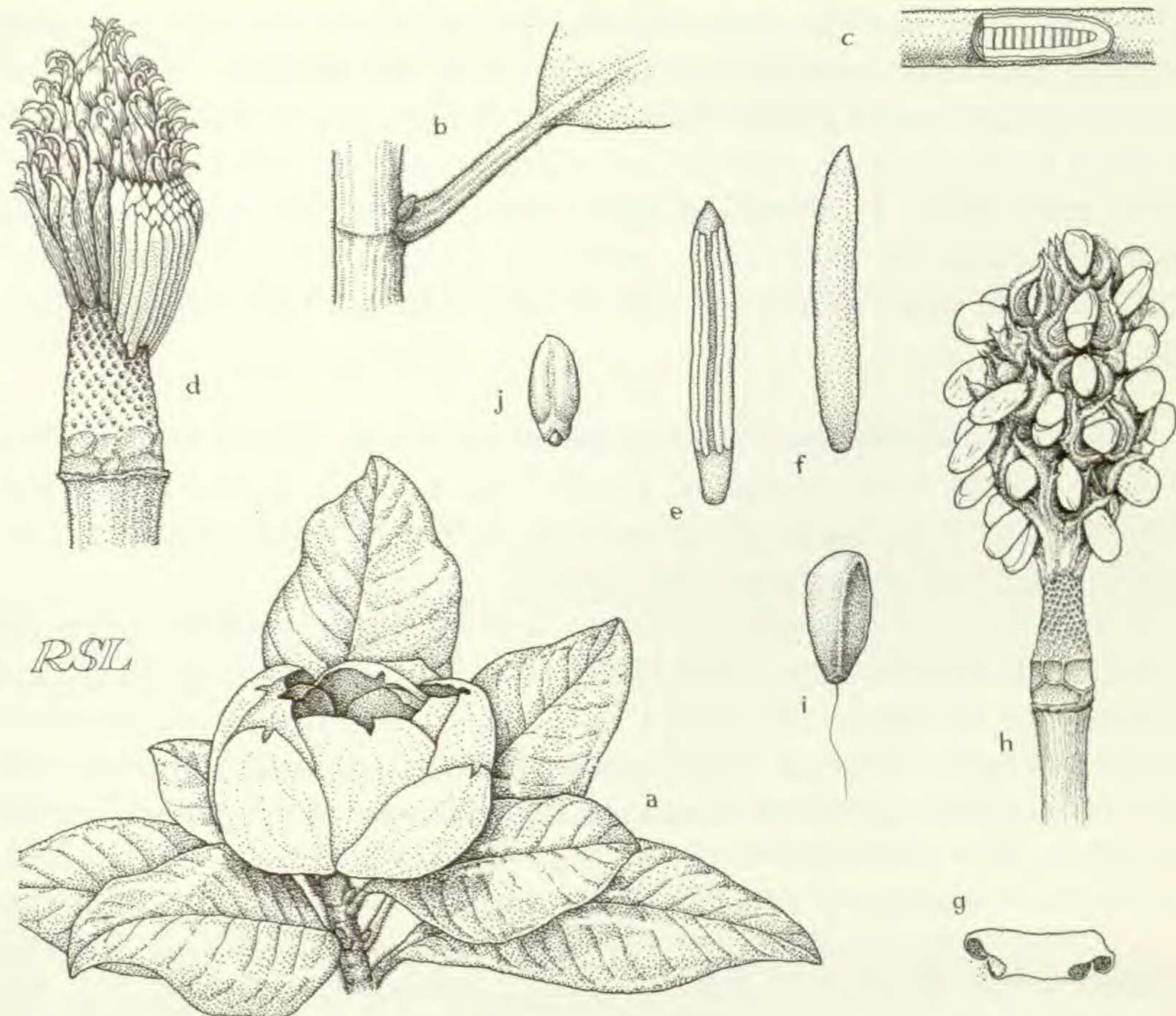


FIGURE 1. *Magnolia* sect. *Theorhodon*. a-j, *M. grandiflora*: a, habit of flowering branchlet of 'Praecox Fastigiata', $\times \frac{1}{3}$; b, branchlet and petiole, showing lack of stipule scar on petiole, $\times \frac{3}{4}$; c, section of branchlet showing septate pith, $\times 1$; d, flower with tepals removed, showing androecium (many stamens removed) and gynoecium, $\times 1$; e, adaxial surface of stamen, showing introrse lines of dehiscence of pollen sacs, $\times 2$; f, abaxial surface of stamen, $\times 2$; g, transverse section through stamen, $\times 6$; h, fruit aggregate, $\times \frac{1}{2}$; i, seed with outer seed coat intact, $\times 1$; j, seed with outer seed coat removed, $\times 1$.

hairs. Leaves falling in spring at 2 years of age; petioles stout, 9–27 mm. long, densely felted with rufous or yellowish hairs, sometimes becoming subglabrous, the stipules free and the petioles lacking stipule scars on the adaxial surfaces; leaf blades stiffly coriaceous, variable in size and shape, (5–)7.9–20(–25.5) cm. long, (2.9–)6–8.7(–14.4) cm. wide, narrowly to broadly elliptic, lanceolate, oblanceolate, ovate, or usually broadly ovate to $\pm$ subglobose, with attenuate, acute, cuneate, or subrounded, often oblique bases, undulate margins, and obtuse to short-acuminate, rarely retuse apices; upper surfaces of the blades dark green (or rarely variegated), brilliantly glossy, glabrous, when dried finely reticulated in a $\pm$ honeycomb pattern; lower surfaces thickly to thinly felted with rufous hairs or occasionally subglabrous with hairs only along the elevated midveins. Flowers large, heavily fragrant, held erect on stout, felted to sericeous pedicels; tepals 9 or 12 (or rarely to 25), thick and fleshy, creamy white, broadly spatulate to broadly obovate or $\pm$ orbicular,

7.5–12 cm. long, 4–9 cm. wide; stamens numerous, 13–21 mm. long, with purplish filaments; gynoecia 2–2.5 cm. long at anthesis, the carpels densely sericeous with silvery hairs, the styles glabrous. Fruit aggregates ovoid, 5.5–7.5 cm. long, yellowish- or silvery-tan, the follicles finely sericeous, with short, $\pm$ ascending styler beaks; lowermost follicles basally decurrent along the floral axis; seeds ca. 12 mm. long, the outer seed coats red, the inner ones ivory. $2n = 114$. (*M. foetida* Sarg.) — BULL BAY.

Native to the Coastal Plain of the southeastern United States from North Carolina south to central Florida and west to eastern Texas and Arkansas (see E. L. Little, Jr., *Atlas of U. S. Trees* 1: *map* 141-E. 1971); widely cultivated throughout the world.

Among the very numerous cultivars of *Magnolia grandiflora*, some are deserving of mention here, while others have been described by McDaniel (*Newsl. Am. Magnolia Soc.* 9(3): 3–7. 1973). For a complete listing of named cultivars, reference should be made to the checklist of Fogg and McDaniel (1975), in which more than 150 cultivars of *M. grandiflora* are accounted for. It should be noted that ‘Galissoniensis’ (= *M. grandiflora* f. *galissoniensis* K. Koch, *Dendr.* 1: 368. 1869; see also, N. Treseder, *Newsl. Am. Magnolia Soc.* 6(1): 3. 1969), a very hardy clone listed by Rehder in his *Manual* (1940), is apparently not in cultivation in the United States (*fide* Fogg & McDaniel, 1975). ‘Exmouth’ (= *M. grandiflora* f. *lanceolata* (Aiton) Rehder, *Bibl. Cult. Trees Shrubs* 180. 1949; γ *lanceolata* Aiton, *Hort. Kew.* 2: 251. 1789; var. *exoniensis* Hort. ex Loudon, *Arb. Brit.* 1: 261. 1838; cv. *Exoniensis*; see also *Bot. Mag. t.* 1952. 1817) is an old clone of narrow pyramidal habit with oblong-elliptic to oblong-lanceolate leaves finely pubescent on the lower surfaces. ‘St. Mary’ (see H. H. Hume, *Morris Arb. Bull.* 12: 16. 1961) is a conical tree with leaves densely dark brown pubescent beneath and with cup-shaped flowers that are produced freely even when the plant is young. ‘Goliath’ (see J. G. Millais, 1927, p. 140, and *Gard. Chron.* III. 148: 309. 1960) is noteworthy for its short, subglobose leaves with blunt apices and glabrous or thinly pubescent under surfaces and for its large flowers that are produced until late in the growing season. ‘Praecox Fastigiata’ is also noted for its continual flowering until late into the growing season, as well as for its fastigate habit. Finally, ‘Charles Dickens’ (see J. W. Templeton, *Morris Arb. Bull.* 16: 8, 9. 1965), $2n = 76$, a tetraploid, is noted for its large, ovoid, bright red fruit aggregates and oblong seeds. Its chromosome number suggests that it comprises a hybrid between *M. grandiflora*, $2n = 114$, and some other species (see J. C. McDaniel, *Newsl. Am. Magnolia Soc.* 7(2): 4–7, 1970). The documented hybrids between *M. virginiana* and *M. grandiflora*, often referred to as the Freeman hybrids, are described below.

MAGNOLIA sect. GYNOPODIUM J. E. Dandy, Bot. Mag. 165: *in nota sub t. 16.* 1948.

Glabrous evergreen trees and shrubs; stipules free from the petioles; gynoecia short-stipitate, the stamens and carpels not contiguous on the floral axis. TYPE SPECIES: *M. nitida* W. W. Smith.

Four species of eastern Asia. Only the type species is known in cultivation.

2. *M. nitida* W. W. Smith, Notes Roy. Bot. Gard. Edinburgh 12: 212. 1920.

Glabrous evergreen trees or large shrubs, in age to ca. 15 m., with rough, ashy-brown bark; branchlets yellowish-green, becoming dark brown, with conspicuous encircling stipule scars at the nodes, the internodes short, $\pm$ regularly spaced; pith septate. Leaves persistent or occasionally falling under severe winter conditions; petioles 1.5–2.5 cm. long, yellowish-green, the stipules free and the petioles without scars on the adaxial surfaces; leaf blades stiffly coriaceous, (5–)8–11.5(–12.7) cm. long, (2–)3–5.5(–8.2) cm. wide, elliptic, oblong-lanceolate or oblong-ob lanceolate, with acute or short-acuminate, rarely emarginate apices, entire margins, and cuneate, obtuse, or rounded bases; upper surfaces of the leaf blades dark glossy green, the venation indistinct; lower surfaces pale green, not shining. Flowers fragrant, becoming $\pm$ saucer-shaped, borne erect at the ends of branchlets on stout pedicels 3–12 mm. long; tepals 9–12, creamy white, the outer 3 flushed purplish on the abaxial surfaces, fleshy, ca. 4–5 cm. long, spatulate to obovate; stamens numerous, 10–17 mm. long; gynoecia short-stipitate, green, the stigmas red. Fruit aggregates bright green, $\pm$ cylindric, 3–7 cm. long; seeds with bright orange outer seed coats. $2n = 38$.

Native to northwestern Yunnan Province, China, northeastern Upper Burma, and southeastern Tibet; marginally hardy within the southern part of our area.

Inasmuch as I have not seen an adequate number of specimens on which to base this description, some of the information included above, particularly concerning the flowers, has been based on J. E. Dandy's article (Bot. Mag. 165: *t. 16.* 1948) and Johnstone's description (1955, pp. 141–143, *pl. 14 & fig. 20*). It is noted in *Hilliers' Manual* (1973, p. 182) that the new shoots of *Magnolia nitida* "have an almost metallic lustre."

MAGNOLIA sect. Gwillimia De Candolle, Reg. Veg. Syst. Nat. 1: 455, 548. 1817, emend. J. E. Dandy, Camellias and Magnolias, Roy. Hort. Soc. Conf. Rep. 67. 1950.

Evergreen trees and shrubs; stipules adnate to the petioles, leaving

scars on the adaxial surfaces of the petioles; fruit aggregates comprised of follicles with short styler beaks. TYPE SPECIES: *M. coco* (Lour.) DC.

Eleven to fourteen species of southeastern Asia. *Magnolia delavayi*, the only temperate species of the section, is marginally hardy in the southern part of our area. *Magnolia coco* (see Bot. Mag. 25: t. 977. 1806), although not included here, is known to be cultivated in warmer temperate and subtropical areas of the United States.

3. *M. delavayi* Franchet, Pl. Delavayanae 33. t. 9, 10. 1889.

Large evergreen shrubs or trees to ca. 10 m., with dark brown, longitudinally fissured bark; branchlets stout, lenticellate, with continuous pith, greenish-tan, at first densely felted with appressed, yellowish-tan hairs, the older growth finely appressed-sericeous, particularly at the nodes, eventually glabrous. Leaves long-petiolate, the petioles (2.6–)3.5–6.7(–8.7) cm. long, often tuberculate, at first densely appressed-sericeous, in age $\pm$ glabrescent, the elongate stipule scars extending almost to the base of the blades; leaf blades thickly coriaceous, elliptic to ovate or oblong-ovate, rarely suborbicular, (10.4–)13–20(–30, *fide* Johnstone) cm. long, (4.3–)5–10.5(–16, *fide* Johnstone) cm. wide, with acute to rounded bases, undulate margins, and rounded to obtuse or occasionally retuse apices (the apex itself often very short-apiculate); upper surfaces of the blades dark, dull green, at first finely pubescent, soon glabrous, reticulate; lower surfaces at first finely pubescent over the entire surface, eventually glabrous, pale green or yellowish, the midveins and major lateral veins conspicuously elevated. Flowers fragrant, $\pm$ cup-shaped, borne on stout, glabrous or sericeous pedicels; tepals 9, fleshy, the outer 3 greenish-white, becoming reflexed, the inner 6 creamy white, spatulate to obovate, (5.5–)7–10 cm. long, 2.5–3.5 cm. wide, the inner tepals more slender; stamens numerous, 1.5–2 cm. long; gynoecia ovoid with $\pm$ acute apices, 3–4 cm. long at anthesis, usually finely pubescent with yellowish hairs, particularly at the base. Fruit aggregates 6.7–9.5 cm. long, ovoid-oblong, becoming light brown, usually with $\pm$ acute apices; follicles finely pubescent or subglabrous, with short, $\pm$ spreading styler beaks. $2n = 38$.

Endemic to Yunnan and Szechwan provinces, China; rarely cultivated in the southern portion of our area.

The only other species cultivated in our region with which *Magnolia delavayi* might be confused is *M. grandiflora*. The two species can be distinguished easily, however, by a comparison of the petioles; long stipule scars occur on the petioles of *M. delavayi*, while scars are lacking on petioles of *M. grandiflora*. Moreover, the septate pith of branchlets of *M. grandiflora* also distinguishes that species from *M. delavayi*, which has continuous pith.

MAGNOLIA sect. MAGNOLIA.

Evergreen to deciduous trees or shrubs; stipules adnate to the petioles, the petioles with stipule scars on the adaxial surfaces; leaf blades glaucous beneath; anthers with the connectives produced into short, acute appendages. TYPE SPECIES: *M. virginiana* L.

A monotypic section comprised of only *Magnolia virginiana* of the eastern United States.

4. *M. virginiana* Linnaeus, Sp. Pl. 1: 535. 1753.

Deciduous, semievergreen or evergreen trees to 30 m., or often large, multiple-trunked shrubs of open, lax habit; bark on old limbs grayish-brown, with small platelets and irregularly furrowed; branchlets glabrous to densely sericeous with silvery hairs, green or yellowish-green, becoming purplish-brown; pith conspicuously septate; terminal winter (mixed) buds finely to thickly sericeous with silvery hairs. Leaves alternate, the yellowish-green petioles 1.5–2(–3) cm. long, subglabrous to finely sericeous, the elongate glabrous or pubescent stipule scars extending almost to the bases of the blades; leaf blades variable, narrowly oblong to elliptic, oblong-elliptic, ovate, or sublanceolate, rarely suborbicular, (3.5–)6.5–10.5 (–17.7) cm. long, (1.5–)3.5–4.5(–6.5) cm. wide, tapering to rounded to acute or very rarely retuse apices and cuneate to acute bases, the margins entire, sometimes finely ciliate; upper surfaces of the blades lustrous green, rarely variegated, glabrous or often puberulent, particularly at base and along the light yellowish-green midveins; lower surfaces silvery-glaucous, rarely green, at first thickly sericeous with silvery hairs, becoming finely sericeous to puberulent. Flowers fragrant, creamy white, $\pm$ globose to cup-shaped, appearing with the leaves on stout, glabrous or sericeous pedicels; tepals 6–15, rarely more, the outer 3 becoming $\pm$ reflexed, the inner tepals 3–5(–9) cm. long, 1.2–2 cm. wide, spatulate to obovate or suborbicular, with rounded apices and short-clawed bases; stamens relatively few, ca. 9 mm. long, the anthers with short, acute appendages; gynoecia glabrous, greenish, ca. 1 cm. long at anthesis. Fruit aggregates becoming pinkish-red at dehiscence, finally dark purplish- or reddish-brown, ovoid, ellipsoid, or subglobose, (2–)3–4.5(–5) cm. long, the follicles with or without very short styler beaks; seeds ca. 1 cm. long, the outer seed coats dark red. $2n = 38$. (*M. virginiana* var. *glauca* L.; *M. glauca* L.; including *M. virginiana* var. *australis* Sarg., *M. australis* Ashe.) — SWEET BAY.

Native to the Coastal Plain and adjacent Piedmont of eastern North America from Massachusetts and New York southward to Georgia and Florida and westward into eastern Texas, Arkansas, and Tennessee (see E. L. Little, Jr., Atlas of U. S. Trees 1: map 142–E. 1971).

Evergreen, semievergreen, or deciduous plants of *Magnolia virginiana* from the southern part of its range, usually developing a tree habit to 30 m., less often large multiple-trunked shrubs, with persistently sericeous branchlets, pedicels, and petioles, have been recognized as var. *australis* Sarg., Bot. Gaz. 67: 231. 1919 (*M. australis* Ashe), but this taxon is included here within the species. J. C. McDaniel, a noted student and authority on *Magnolia* who has made studies of the variation encountered in *M. virginiana*, is convinced that the recognition of var. *australis* (and perhaps yet another variety) is justified, and reference should be made to his major article on this subject (Morris Arb. Bull. 17: 7-12. 1966). However, while behavioral and other characters outlined by McDaniel are indeed evidence of differences between northern and southern populations of *M. virginiana*, it would seem that differences are to be expected within a wide-ranging species. Inasmuch as most of the characters are ill defined morphologically and are clinal over the range, a utilitarian taxonomy does not appear to result from the recognition of a southern variety.

Three hybrids involve *Magnolia virginiana* and species of sect. RYTIDOSPERMUM, namely *M. virginiana* $\times$ *M. hypoleuca*, *M. virginiana* $\times$ *M. macrophylla*, and *M. virginiana* $\times$ *M. tripetala*, the hybrid group that has received the collective name *M. \times thompsoniana* (q.v.). The first two hybrids are not described here (but see under *M. hypoleuca* and *M. macrophylla*), inasmuch as I have not seen specimens documenting these hybrids and they are not known to me to be widely distributed in American gardens or arboreta.

A second group of hybrids involves *Magnolia virginiana* and species of sect. THEORHODON. The hybrid *M. virginiana* $\times$ *M. grandiflora* is described below, while *M. virginiana* $\times$ *M. guatemalensis*, although known to be hardy as far north as Maryland, is not accounted for here for the same reasons outlined above. It should also be noted that plants of *M. guatemalensis* J. D. Smith, Bot. Gaz. 47: 253. 1909, a species of sect. THEORHODON from Guatemala, have been distributed from the United States National Arboretum, but are not known by me to be hardy in our area.

MAGNOLIA sect. RYTIDOSPERMUM Spach, Hist. Nat. Veg. Phanerog. 7: 474. 1839.

Deciduous trees or large shrubs; leaves crowded into false whorls at the ends of branchlets, alternate and widely spaced on new shoots. TYPE SPECIES: *M. tripetala* L.

As defined here, three American species of the Temperate Zone (two comprised of two subspecies each) and three species of eastern Asia.

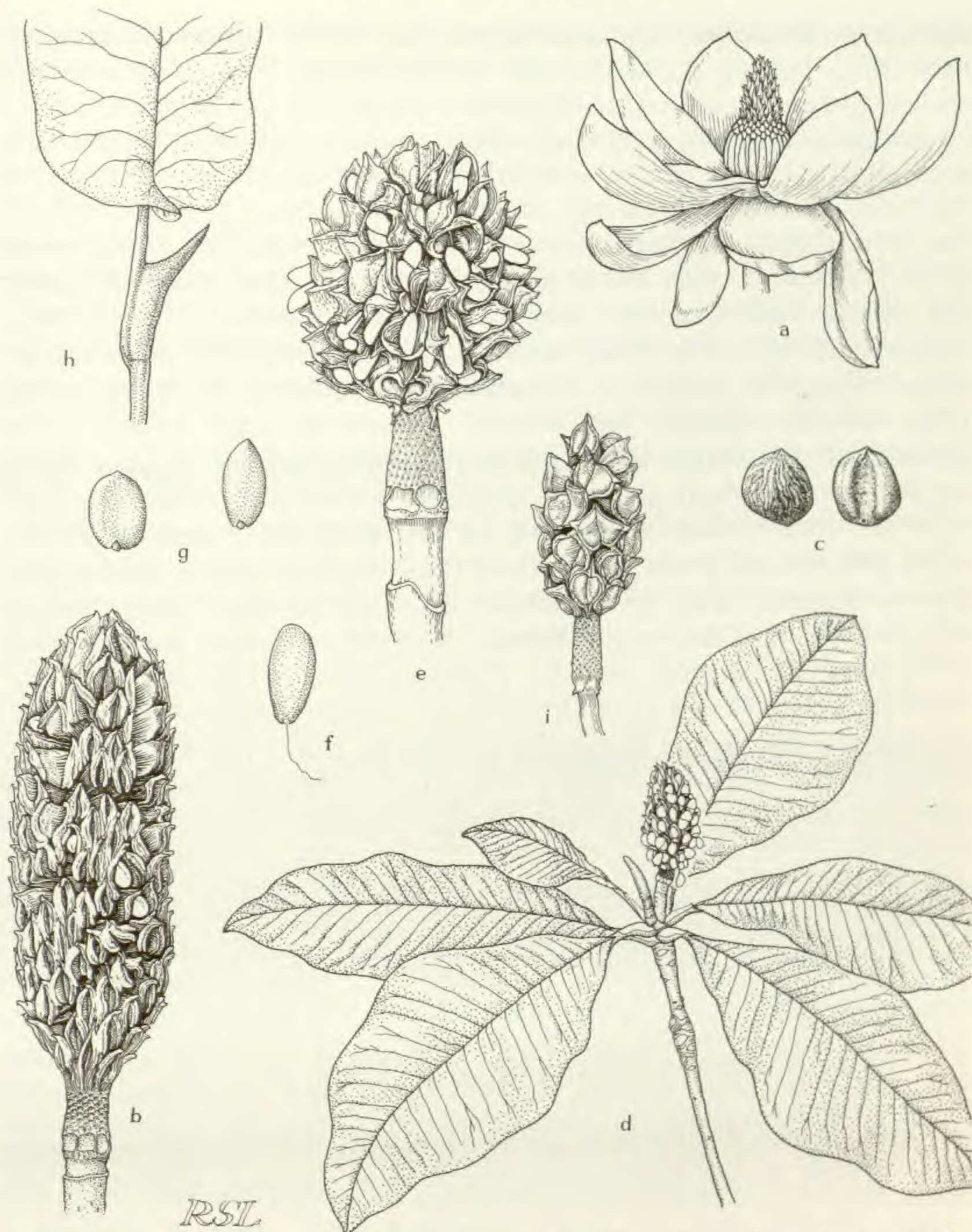


FIGURE 2. *Magnolia* sect. *Rytidospermum*. a-c, *M. hypoleuca*: a, flower, $\times \frac{1}{3}$; b, fruit aggregate with obsolete styler beaks, $\times \frac{1}{2}$; c, seeds with the outer seed coats removed to show surface grooving of inner seed coats, $\times 1$. d, habit of branchlet with fruit aggregate of *M. tripetala*, $\times \frac{1}{6}$. e-g, *M. macrophylla* subsp. *macrophylla*: e, fruit aggregate, $\times \frac{1}{2}$; f, seed with outer seed coat intact, $\times 1$; g, seeds with outer seed coats removed, $\times 1$. h, i, *M. macrophylla* subsp. *ashei*: h, lower portion of leaf showing auriculate base and stipules enclosing terminal bud, $\times \frac{1}{3}$; i, fruit aggregate, $\times \frac{1}{2}$.

5. *M. macrophylla* Michaux, Fl. Bor.-Am. 1: 327. 1803.

FIGURE 2, e-i.

Deciduous trees to 15 or rarely 20 m., usually of slender upright habit, occasionally widely branching, the bark on trunk and older limbs smooth,

light gray; branchlets stout, green, at first thickly tomentose with silvery hairs, becoming glabrous and reddish-brown, with prominent leaf scars clustered in groups (the internodes very short), the groups separated by elongated internodes; terminal winter (mixed) buds thickly tomentose with silvery hairs. Leaves crowded into false whorls at the ends of branchlets or alternate on new shoots; petioles stout, (3–)5.5–13(–15) cm. long, densely to finely tomentose like the young branchlets, sometimes glabrescent, with elongate stipule scars on the adaxial surfaces; leaf blades membranaceous, very large, (18–)24–60(–100?) cm. long, (8.9–)11–26(–32) cm. wide, broadly elliptic, oblanceolate, or oblong-oblanceolate with cordate to auriculate, rarely subtruncate bases, entire, often undulate margins, and rounded, obtuse, or acute apices; upper surfaces of the blades green, glabrous; lower surfaces of the blades chalky white to silvery-glaucous, sometimes glaucescent, finely pubescent over the entire surface, particularly on and along the conspicuously elevated midveins and major lateral veins, occasionally becoming subglabrous. Flowers fragrant, large, $\pm$ cup-shaped, held erect on stout, silvery-tomentose pedicels ca. 5 cm. long, subtended by a false whorl of leaves; tepals 9, irregular and unequal, the outer 3 greenish, usually narrowly spatulate, becoming yellowish and reflexed, the inner 6 creamy white, often purplish-spotted near the base on the adaxial surface, 14.5–20.5 cm. long, 5–14 cm. wide, broadly spatulate, elliptic, ovate, or suborbicular, with broad or abruptly constricted, short-clawed bases; stamens creamy white, very numerous, 15–18 mm. long; gynoecia 2–3 cm. long at anthesis, the carpels with densely silvery-pubescent ovaries and glabrous styles. Fruit aggregates subglobose to globose, 5.5–8 cm. long, rosy-colored at dehiscence, becoming grayish-brown; follicles pubescent, with stout beaks, or sometimes the beaks obsolete, the lowermost follicles dehiscing $\pm$ downward, with the floral axis forming an angle of ca. 90° ; seeds 1–1.4 cm. long, the outer seed coats pinkish-red or coral red. $2n = 38$.

Native to rich woodlands of the southeastern United States in Georgia and Alabama to Louisiana northward to West Virginia, Kentucky, and Arkansas.

Plants developing a shrublike habit to 10 m., with the stout branchlets at first heavily glaucous and finely tomentose with silvery hairs, often with slightly smaller flowers (the largest tepals 10–13 cm. long, 3–6.5 cm. wide), the stamens 11–13 cm. long, and with the mature fruit aggregates subcylindric to ovoid, (4.5–)5–7 cm. long, the lowermost follicles and the floral axis forming an oblique angle, are recognized here as *Magnolia macrophylla* subsp. *ashei* (Weatherby) Spongberg, comb. et stat. nov. (BASIONYM: *Magnolia ashei* Weatherby, *Rhodora* 28: 35. 1926). *Magnolia macrophylla* subsp. *ashei*, $2n = 38$, is apparently endemic to the panhandle of northwestern Florida, where it is most frequently encountered in the Knox Hill region of Walton County. While it has also been reported from eastern Texas (Vines, 1960), the records

are probably based on cultivated plants of *M. macrophylla* subsp. *macrophylla*.

The nature of the differences between plants of the two subspecies of *Magnolia macrophylla* (in habit, length of stamens, young branchlet characters, and shape of fruit aggregates), as well as their distinct geographical distribution in nature, suggests that the taxonomic treatment accorded these taxa as subspecies best reflects these differences while also recognizing their extremely close relationships.

A hybrid between *Magnolia macrophylla* subsp. *macrophylla* and *M. virginiana* has been produced, but since specimens of this hybrid have not been examined, it is not described here.

6. *M. fraseri* Walter, Fl. Carol. 159. 1788.

Small trees to ca. 14 m., usually of open, spreading habit, with smooth, brownish or grayish bark; branchlets slender to $\pm$ stout, glabrous, dark purplish- or reddish-brown, with prominent transverse-elliptic leaf scars clustered in groups (the internodes very short), the groups separated by elongated internodes; terminal winter (mixed) buds glabrous, purplish or greenish. Leaves crowded into false whorls at the ends of branchlets or alternate on new shoots; petioles slender, 3–6(–13) cm. long, glabrous, with elongate stipule scars on the adaxial surfaces; leaf blades membranaceous, broadly spatulate, elliptic, or broadly lanceolate, (11.3–)14.8–26.5(–53) cm. long, (5.5–)8.4–18(–29) cm. wide, with obtuse to acute apices, entire margins, and subcordate, rarely truncate, or usually auriculate bases; upper surfaces of the blades green, glabrous; lower surfaces glaucescent, the midveins and major lateral veins prominently elevated. Flowers sweetly scented, $\pm$ vase-shaped, becoming saucer-shaped, held erect on stout pedicels 2–3.5(–4) cm. long at the ends of branchlets, subtended by a false whorl of leaves; tepals 9, yellowish or creamy white, the outer 3 subequal or rarely longer than the inner 6, with broad bases, the inner 6 broadly spatulate, lanceolate, or obovate, with rounded to acute apices and narrow, $\pm$ clawed bases, (7–)8–12(–14) cm. long, 2.4–4.7 cm. wide; stamens numerous, 8–15 mm. long; gynoecia 2–2.8 cm. long at anthesis, glabrous. Fruit aggregates 6.5–11 cm. long, ellipsoid, bright red at dehiscence, becoming dark, purplish-brown, the follicles with long, spreading, hooked styler beaks; seeds ca. 1 cm. long, the outer seed coats red. $2n = 38$. (*M. auriculata* Bartram.)

Native to rich forests in the mountains of the southeastern United States from Virginia and West Virginia south to Alabama and Georgia and west to Louisiana and eastern Texas (Jasper County).

Plants of the lower Piedmont and Coastal Plain of the southeastern United States from South Carolina into northern Florida and westward through Alabama and Mississippi to eastern Texas (Jasper and Newton counties) comprise *Magnolia fraseri* var. *pyramidata* (Bartram) Pampanini, Bull. Soc. Tosc.ortic. 40: 230. 1915 (*M. pyramidata* Bartram,

M. auriculata β *pyramidata* Nuttall). Usually small trees (rarely to ca. 16 m.) of pyramidal form with ascending branches and leaves often $\pm$ pandurate or rhombic in outline, plants of var. *pyramidata*, $2n = 38$, can be distinguished from var. *fraseri* by their shorter stamens 4–6 mm. long, their smaller gynoecia ca. 1.5 cm. long at anthesis, and their shorter fruit aggregates 3.5–5.5(–6) cm. long. Miller (1975) states that “there is a gradual transition between [var.] *pyramidata* of Florida and [var.] *fraseri* of the mountains, since the Alabama and Georgia plants form a continuous sequence from north to south in these states.” While Clark (1971) has totally submerged var. *pyramidata* within *M. fraseri*, the Piedmont and Coastal Plain plants are recognized here as a variety, since the two taxa, based on the wild and cultivated specimens examined during this study, can be distinguished by the characters outlined above.

Hybrids between *Magnolia fraseri* and *M. hypoleuca* and *M. fraseri* and *M. tripetala* have been produced by P. J. Savage, Jr., but are not described here because of their limited distribution in cultivation. (See discussion under *M. hypoleuca*.)

7. *M. tripetala* Linnaeus, Syst. Nat. ed. 10. 2: 1082. 1759.

FIGURE 2, d.

Small deciduous trees of open habit to 12 m., sometimes shrublike, with several limbs from near the base; bark smooth, ash-gray, lenticellate, with fine longitudinal fissures developing on old trunks; branchlets stout, brittle, brownish- or purplish-gray, with continuous pith and prominent transverse-elliptic or suborbicular leaf scars clustered in groups (the internodes very short), the groups separated by elongated internodes; terminal winter (mixed) buds large, purplish, glaucous. Leaves crowded into false whorls at the ends of branchlets or alternate on new shoots; petioles stout, (1–)2–3.5 cm. long, yellowish-green, dilated at the bases, with prominent stipule scars on the adaxial surfaces; leaf blades large, membranaceous to subcoriaceous, (15–)22–38(–60) cm. long, (6–)10–23.5 cm. wide, obovate-lanceolate, tapering to cuneate bases and acute apices, the margins entire and often undulate; upper surfaces of the blades green, glabrous; lower surfaces grayish-green, finely but thickly villous over the entire surface (particularly along the elevated, purplish or yellowish-green midveins and prominent lateral veins), the hairs $\pm$ appressed or crisped, the surfaces sometimes becoming subglabrous in age. Flowers $\pm$ vase-shaped, of disagreeable odor, held erect on stout, glabrous pedicels at the ends of branchlets, subtended by a false whorl of leaves; tepals 9 or 12, the outer 3 with broad bases, slightly shorter than the inner tepals, oblong-spatulate in outline, light greenish-white, usually reflexed at anthesis, the inner 6 or 9 creamy white, thick and fleshy, 8–12 cm. long, 2.6–4 cm. wide, obovate to oblong-elliptic in outline, tapering to narrow, $\pm$ clawed bases; stamens 1.5–2.2 cm. long, the filaments reddish, the anther sacs creamy white; gynoecia ca. 2.5 cm. long at anthesis, pinkish. Fruit aggregates ovoid-cylindric, 7–10 cm. long, green, becoming pinkish

at dehiscence, finally purplish-brown; seeds ca. 1 cm. long, the outer seed coats pinkish-red, the inner ones roughened by longitudinal grooves. $2n = 38$. (*M. umbrella* Desrouss.) — UMBRELLA-TREE, ELKWOOD.

Native to rich woods of eastern North America from southern Pennsylvania and West Virginia south into Florida (Okaloosa County) and westward through Ohio and Kentucky to Arkansas and Missouri; sometimes escaped from cultivation northward into central Massachusetts.

Magnolia tripetala has been involved in a number of hybrids, and one, *M. tripetala* $\times$ *M. sieboldii*, an intersectional hybrid, is represented in cultivation by the cultivar 'Charles Coates' (see J. R. Sealy, Gard. Chron. III. 152: 77. 1962). A tall, loosely branched shrub, 'Charles Coates' produces flowers that most closely resemble those of *M. sieboldii*. They are $\pm$ saucer-shaped, the inner tepals, 5.5–7.5 cm. long and 2–4.5 cm. wide, are ovate to broadly elliptic with short-clawed bases, and the androecium is purplish-red. However, the flowers are held erect like those of *M. tripetala*, the tepals have rumpled margins, and the leaves, which tend to be clustered in false whorls at the ends of branchlets, are broadly elliptic, 12–25 cm. long, 6.5–13.5 cm. wide, with cuneate bases and acute apices.

Magnolia thompsoniana (q.v.) is the collective epithet for hybrids between *M. tripetala* and *M. virginiana*, while *M. tripetala* $\times$ *M. hypoleuca* is discussed briefly under the latter species. Other reports of hybrids involving or suspected of involving *M. tripetala* (see J. C. McDaniel, Newsl. Am. Magnolia Soc. 11(1): 9–11. 1975) include *M. tripetala* $\times$ *M. officinalis* var. *biloba*, *M. tripetala* $\times$ *M. fraseri*, and *M. tripetala* $\times$ *M. macrophylla*, the last two hybrids being the results of intentional cross-pollinations made by P. J. Savage, Jr. The results of these hybridizations may eventually be of horticultural significance; however, the hybrids are currently of limited distribution in cultivation and are not described here, since documenting herbarium specimens have not been seen.

8. *M. hypoleuca* Siebold & Zuccarini, Abh. Math.-Phys. Acad. Wiss. München 4(2): 187. 1846; Fl. Jap. Fam. Nat. 1: 79. 1846.

FIGURE 2, a–c.

Large, widely branching deciduous trees, old specimens attaining 30 m., with silvery-gray, lenticellate bark; branchlets brittle, purplish or silvery (the periderm exfoliating in very thin, opaque sheets), with prominent leaf scars clustered in groups (the internodes very short), the groups separated by elongated internodes; terminal winter (mixed) buds large, purplish-green, glabrous. Leaves crowded into false whorls at the ends of branchlets or alternate and widely spaced on new shoots; petioles glabrous, purplish, (1–)2.5–3.5(–7) cm. long, stout, dilated at base, with prominent stipule scars on the adaxial surfaces; leaf blades large, subcoriaceous, (10–)16–45(–50) cm. long, (5.8–)9–20(–25) cm. wide, oblong-obovate, tapering to rounded, truncate, or usually broadly cuneate

bases, the apices abruptly acute or occasionally rounded, the margins entire and often undulate; upper surfaces of the blades green, glabrous; lower surfaces silvery or grayish-green, at first densely silky-pubescent over the entire surface with fine, $\pm$ appressed, crisped hairs, becoming less pubescent or subglabrous with age. Flowers cup- or saucer-shaped, heavily scented, held erect at the ends of branchlets on stout, glabrous pedicels, subtended by a false whorl of leaves; tepals 9–12, $\pm$ fleshy, the outer 3 shorter than the inner tepals, pale tan-green, sometimes tinged pinkish on the abaxial surfaces, $\pm$ oblong-spatulate in outline, with broad bases, the inner 6 or 9 tepals creamy white, elliptic to obovate in outline, tapering to relatively narrow bases, 8.5–12 cm. long, 1.5–4.5 cm. wide; stamens numerous, 1.5–2(–3) cm. long, the filaments purplish-red, the anther sacs creamy yellow; gynoecia ca. 3 cm. long at anthesis, the styles crimson. Fruit aggregates scarlet at dehiscence, finally light tan or brown, 13.5–20 cm. long, oblong-cylindric, the follicles with spreading styler beaks or the beaks obsolete, the lowermost follicles concave and decurrent along the floral axis; seeds 8–11 mm. long, with bright red outer seed coats, the inner, black seed coats longitudinally grooved. $2n = 38$. (*M. obovata* Thunberg; *M. glauca* Thunberg, not L.) — JAPANESE WHITEBARK MAGNOLIA.

Native to altitudes of 1,800 m. in mountainous regions of the southern Kurile Islands, the Japanese islands of Hokkaido, Honshu, Shikoku, and Kyushu, and the Ryukyu Islands. (See distribution map 86 in Y. Hori-kawa, *Atlas of the Japanese flora, an introduction to plant sociology of East Asia*. 12 pp. + 500 maps + viii pp. + map in pocket. Tokyo. 1972.)

Hybrids between *Magnolia hypoleuca* and *M. sieboldii* have been given the collective name *M. $\times$ wieseneri*, described below, while an F_1 generation of hybrids between *M. hypoleuca*, the seed parent, and *M. virginiana*, the pollen parent, were produced in 1956 by W. F. Kosar at the United States National Arboretum. Specimens of these hybrid plants, which are apparently sterile (see Morris Arb. Bull. 20: 65. 1969), are almost indistinguishable from specimens of *M. $\times$ thompsoniana* (q.v.), and they would be traced to that hybrid group in the key presented in this treatment. While these hybrids are not yet in cultivation other than at the National Arboretum, a cultivar selected from the plants is expected to be distributed to nurseries for propagation in the near future. Likewise, *M. hypoleuca* $\times$ *M. fraseri* and *M. hypoleuca* $\times$ *M. macrophylla* have been produced as the results of intentional cross-pollinations by P. J. Savage, Jr., a noted *Magnolia* authority (see J. C. McDaniel, Newsl. Am. Magnolia Soc. 11(1): 9–11. 1975). These hybrids are not known by me to be grown outside of the collections of a few *Magnolia* specialists and hybridizers, and I have not seen documenting herbarium specimens.

Another hybrid, involving *Magnolia hypoleuca* and the closely related *M. tripetala*, has been reported as occurring spontaneously in cultivation in Poland (see E. V. Vašák, Newsl. Am. Magnolia Soc. 9(1): 3–6. 1973).

A large tree upwards of 10 m., with the habit of *M. hypoleuca* and growing in the Arnold Arboretum (Accession #1280-27-C), is also undoubtedly *M. hypoleuca* $\times$ *M. tripetala*. Despite its overall resemblance to *M. hypoleuca*, the putative hybrid can be distinguished from that species by its more nearly elliptic leaf blades, its flowers intermediate between those of the two parents, and its fruit aggregates, which agree almost exactly with those of *M. tripetala*. The Arnold Arboretum plant was grown from seed collected from an Arboretum plant of *M. hypoleuca* (Accession #15172; now dead) that was growing in close association with *M. tripetala*. The seed parent, in turn, had been grown from seed of *M. hypoleuca* collected in Japan by C. S. Sargent in 1892.

9. *M. officinalis* Rehder & Wilson, Pl. Wilsonianae 1: 391. 1913.

Deciduous trees to 20 m., very similar to *Magnolia hypoleuca*; bark rusty ash-gray, the stout branchlets yellowish or yellowish-gray, finally light gray, becoming longitudinally striate when dried, the prominent leaf scars clustered in groups (the internodes very short), the groups separated by elongated internodes; periderm exfoliating in thin sheets; terminal winter (mixed) buds large, greenish-brown, glabrous. Leaves large, clustered in false whorls at the ends of branchlets or alternate and widely spaced on new shoots; petioles glabrescent, stout, 2.5-3.8(-4) cm. long, yellowish-green, dilated at base, with conspicuous stipule scars on the adaxial surfaces; leaf blades membranaceous to subcoriaceous, (10-) 22-40 cm. long, (5.5-) 11-20 cm. wide, oblong-obovate, tapering to rounded, acute, or usually cuneate bases, the apices rounded to abruptly acute, the margins entire, undulate; upper surfaces of the blades green, glabrous; lower surfaces silvery or grayish-green, at first densely felted over the entire surface with fine, $\pm$ appressed, crisped hairs, the lamina becoming subglabrous but distinctly glaucous. Flowers heavily scented, held erect at the ends of branchlets on stout, glabrous to silky-pubescent or felted pedicels, subtended by a false whorl of leaves; tepals 9-12(-17), $\pm$ thick and fleshy, the outer 3 subequal to the inner tepals, oblong-spatulate, pale greenish-white, often tinged with pink on the abaxial surfaces, becoming reflexed during anthesis, the inner 6-9(-14) tepals creamy white, obovate to spatulate, 8-10 cm. long, 2.5-4.4 cm. wide, tapering to relatively narrow, $\pm$ clawed bases; stamens ca. 1.5 cm. long, with reddish filaments and creamy yellow anther sacs; gynoecia 2.5-3 cm. long at anthesis, the stigmas reddish. Fruit aggregates red at dehiscence, finally reddish- or purplish-brown, 9-15 cm. long, oblong-ovoid, with obtuse to $\pm$ acute apices, the follicles with short, spreading stylar beaks; lowermost follicles rounded (convex) at base, not decurrent along the floral axis; seeds ca. 1 cm. long, with red outer seed coats, the inner seed coats black, longitudinally grooved. $2n = 38$.

Apparently once native to a wide area of Central China, where it is now thought to persist only as a cultivated plant. Rehder and Wilson

comment that individuals of this species have been eliminated from natural habitats owing to the collection of its bark, which is of reputed medicinal value.

The differences between *Magnolia officinalis* and the Japanese *M. hypoleuca* are few and largely subjective. It is probable that the Chinese plants should be treated at a subspecific rank under *M. hypoleuca*. I have not, however, seen enough material on which to base such a transfer and change in rank, and *M. officinalis* is therefore maintained here provisionally as a species. My observations indicate that the only consistent difference between *M. officinalis* and *M. hypoleuca* is the attitude of the basal follicles of the mature fruit aggregates. The basal follicles of *M. hypoleuca* are concave and decurrent along the floral axis, giving the aggregate an attenuate base, while the lowermost follicles of *M. officinalis* are convex and not decurrent along the axis below, giving the aggregate a rounded base. While the pedicels of *M. hypoleuca* are consistently glabrous, those of the majority of specimens of *M. officinalis* examined are densely pubescent at anthesis. Yet one or two collections of *M. officinalis*, including the type collection (*Wilson 652*), represent plants in flower with both pubescent and glabrous pedicels. Likewise, the pubescence of immature petioles (usually pubescent in *M. officinalis* and glabrous in *M. hypoleuca*) is not a sound character on which to distinguish the two taxa. The branchlets of *M. officinalis* are yellowish-gray and become longitudinally striate when prepared as herbarium specimens. Branchlets of *M. hypoleuca* are purplish- or silvery-brown and, it would appear, fail to become striate when dried.

Plants of *Magnolia officinalis* with all or the great majority of the leaves emarginate at the apex have been described as var. *biloba* Rehder & Wilson, *Pl. Wilsonianae* 1: 392. 1913 (= cv. *Biloba*; *M. biloba* (Rehder & Wilson) Cheng²), and this variety also probably occurs today only as a cultivated plant. Rehder and Wilson state that var. *biloba* agrees with var. *officinalis* in all features except the character of the leaf apex, and Johnstone (1955), in suggesting that the recognition of var. *biloba* is tenuous, states that bilobed leaves occasionally occur on plants of var. *officinalis*. However, my observations indicate that the stipular scales enclosing terminal buds on branchlets of var. *biloba* are consistently pubescent with rufous hairs on the outer surfaces, while the inner surfaces are densely felted with these hairs. In both var. *officinalis* and *M. hypoleuca* the corresponding scales are glabrous. This type of pubescence, together with other morphological characters, suggests the close relationship of these three taxa with *M. rostrata* W. W. Smith, *Notes Roy. Bot. Gard. Edinburgh* 12: 213. 1920 (excluding the description of flowers),

² *Magnolia officinalis* var. *biloba* was proposed as a distinct species by Cheng in *Iconographia Cormophytorum Sinicorum* 1: 787. 1972. The basionym for this combination is not given, suggesting that this reference may not be the original publication of the combination by Cheng. Efforts to locate an earlier reference in the Chinese literature, however, have not been successful.

another species (rare in cultivation in warmer temperate climates) with which, in the absence of mature fruit aggregates, both *M. hypoleuca* and *M. officinalis* may be confused.

MAGNOLIA sect. OYAMA Nakai, Fl. Sylv. Koreana 20: 117. 1933.

Small deciduous trees or shrubs; flowers nodding or pendent; stamens reddish, with blunt or rounded apices; fruit aggregates pendent. TYPE SPECIES: *M. sieboldii* Sieb. & Zucc.

As accounted for here, including three eastern Asiatic species, one comprised of two subspecies, all known in cultivation in western gardens.

10. *M. globosa* J. D. Hooker & T. Thomson, Fl. Indica 1: 77. 1855.

FIGURE 3, 1.

Deciduous shrubs or small trees to ca. 7 m., usually of wide-spreading habit; branchlets slender to $\pm$ stout, reddish-brown or dark reddish-purple, at first densely felted with rufous pubescence, eventually glabrous; terminal winter (mixed) buds densely rufous-pubescent to nearly glabrous. Petioles 2.5–4(–5.5) cm. long, densely sericeous with silvery, yellowish, or rufous hairs, sometimes becoming subglabrous in age, the elongate stipule scars on the adaxial surfaces extending more than half the lengths of the petioles; leaf blades elliptic, broadly ovate, oblong-ovate, or usually obovate, (6–)–21(–23) cm. long, (4.5–)7–9(–14.5) cm. wide, with acute to $\pm$ rounded apices, entire margins (usually ciliate when young), and acute or usually rounded or subcordate, sometimes $\pm$ truncate bases; upper surfaces of the blades glossy dark green, with short, crisped hairs along the midveins and major lateral veins, otherwise glabrous; lower surfaces glaucous, finely pubescent over the entire surface with $\pm$ appressed, crinkled hairs; when immature and expanding, the lower surfaces with dense, felted or woolly, rufous, yellowish, or silvery pubescence along the midveins and major lateral veins, this pubescence sometimes persisting. Flowers fragrant, creamy white, cup-shaped or subglobose, appearing with the leaves, pendent or nodding on stout, rufous-pubescent pedicels (3.5–)4.5–6.5 cm. long; tepals 9–12, the outer whorl of 3 similar in size and shape to the inner tepals, the inner tepals spatulate to obovate or elliptic, with rounded apices, 4–7(–7.5) cm. long, 2–3 cm. wide; stamens 12–17 mm. long, reddish-purple; gynoecia ca. 3.5 cm. long at anthesis, greenish. Fruit aggregates pinkish at dehiscence, finally reddish-brown, cylindric, 6–8 cm. long, with curving styler beaks; seeds ca. 7 mm. long, the outer seed coats red. $2n = 38$. (*M. tsarongensis* W. W. Smith & G. Forrest.)

Native to a wide area from eastern Nepal, Bhutan, and northeastern Assam to southeastern Tibet, northern Burma, and western China (northwestern Yunnan Province).

For *Magnolia wilsonii* $\times$ *M. globosa*, see under *M. wilsonii*.

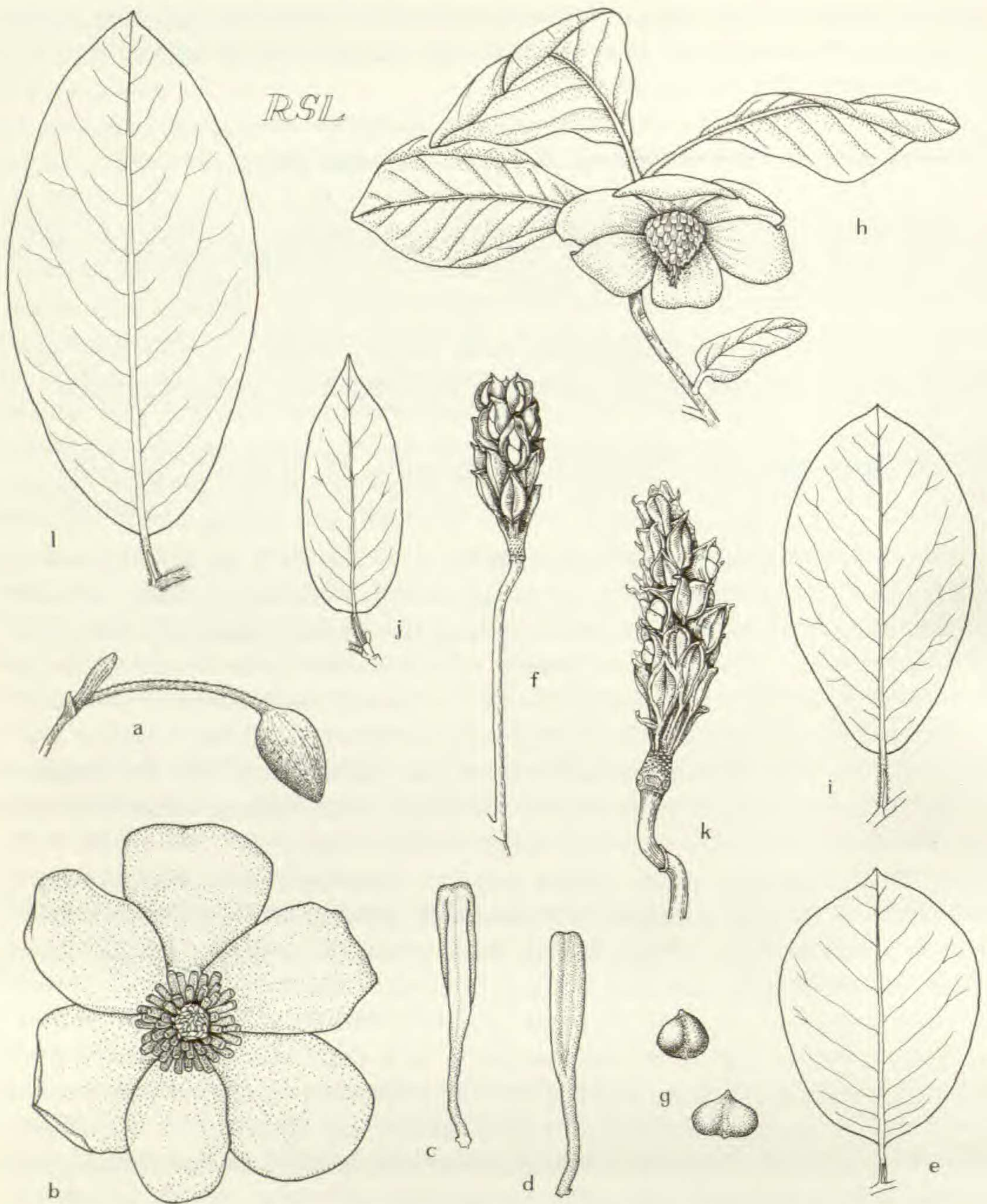


FIGURE 3. *Magnolia* sect. *Oyama*. a–g, *M. sieboldii* subsp. *sieboldii*: a, flower bud, $\times \frac{1}{2}$; b, flower, $\times \frac{1}{2}$; c, adaxial view of stamen showing lines of anther sac dehiscence and blunt apex, $\times 3$; d, abaxial view of stamen, $\times 3$; e, outline of typical leaf, $\times \frac{1}{3}$; f, fruit aggregate, $\times \frac{1}{2}$; g, seeds, the outer seed coats removed, $\times 1$. h, i, *M. sieboldii* subsp. *sinensis*: h, habit of flowering branchlet, $\times \frac{1}{3}$; i, outline of typical leaf, $\times \frac{1}{3}$. j, k, *M. wilsonii*: j, outline of typical leaf, $\times \frac{1}{3}$; k, fruit aggregate, $\times \frac{1}{2}$. l, *M. globosa*, outline of typical leaf, $\times \frac{1}{3}$.

11. *M. wilsonii* (Finet & Gagnepain) Rehder, *Pl. Wilsonianae* 1: 395. 1913. FIGURE 3, j, k.

Deciduous shrubs or small trees to ca. 8 m., often of $\pm$ straggling habit, the brownish bark with conspicuous corky lenticels; branchlets slender, dark reddish-purple, becoming dark grayish-purple, at first dense-

ly sericeous with rufous hairs, eventually glabrous; terminal winter (mixed) buds greenish-brown, thinly to densely pubescent with rufous hairs. Petioles slender, (0.4–)1–3(–4) cm. long, densely sericeous with rufous hairs, becoming less so in age, the elongate stipule scars on the adaxial surfaces extending more than half the lengths of the petioles; leaf blades elliptic or usually lanceolate to oblong-ovate, (4–)6.5–15.5 (–20) cm. long, (2.5–)3–7(–11) cm. wide, with truncate or rounded, rarely cuneate or acute bases, entire margins (sometimes ciliate when young), and acute to acuminate apices; upper surfaces of the blades green, at first with scattered hairs along the midveins and major lateral veins, otherwise glabrous; lower surfaces thickly felted to thinly sericeous over the entire surface (when felted, the hairs obscuring the glaucous lamina), the hairs along the often obscured midveins and major lateral veins yellowish or rufous, the other hairs silvery-gray, without pigment deposition in the crosswalls. Flowers fragrant, cup-shaped at first, becoming saucer-shaped, appearing with the leaves, pendent on slender, $\pm$ sericeous pedicels 1.5–4.5 cm. long; tepals 9 or occasionally 12(–16), the outer 3 subequal to the inner tepals, narrowly lanceolate to spatulate, with acute to rounded apices and tapering to relatively broad bases, the inner tepals pure white, 4–6.5(–7.5) cm. long, 3–4.5(–5.5) cm. wide, in outline broadly spatulate to obovate or suborbicular, with rounded apices and short-clawed bases; stamens 9–12 mm. long, rosy-purple; gynoecia ca. 2 cm. long at anthesis, greenish. Fruit aggregates pendent, pinkish at dehiscence, becoming purplish-brown, cylindric, (5.5–)6–10 cm. long, with spreading styler beaks; seeds ca. 6 mm. long, the outer seed coats red. $2n = 38$. (*M. parviflora* var. *wilsonii* Finet & Gagnepain; including *M. \times highdownensis* Dandy = *M. wilsonii* $\times$ *M. sieboldii* subsp. *sinensis*, as *M. sinensis*.) — WILSON'S MAGNOLIA.

Native to eastern Sikang, western Szechwan, and northern Yunnan provinces, China, where it has been collected at altitudes between 1,900 and 3,300 m.

Plants with the leaves decidedly glaucous on the lower surfaces of the blades and, except for the rufous-pilose midveins, sparsely appressed-pubescent or glabrescent have been recognized as f. *nicholsoniana* (Rehder & Wilson) Rehder, Jour. Arnold Arb. 20: 91. 1939 (*M. nicholsoniana* Rehder & Wilson; *M. taliensis* W. W. Smith; *M. wilsonii* f. *taliensis* (W. W. Smith) Rehder). This form was discovered by E. H. Wilson in the vicinity of Wa-shan, in western Szechwan Province.

One specimen of *Magnolia wilsonii* examined, *Williams s.n.* (AAH), consists of what appears to be a double-flowered form with 15 or 16 tepals. This collection was made from a plant grown at Wakehurst Place, Sussex, England; the plant is also referred to by Johnstone (1955, p. 125). It is not known, however, whether this or similar forms of *M. wilsonii* have been introduced into American gardens.

Putative hybrids between *Magnolia wilsonii* and *M. sieboldii* subsp. *sinensis* (as *M. sinensis*) have received the collective name *M. \times high-*

downensis Dandy, Jour. Roy. Hort. Soc. 75: 159. fig. 82. 1950 (see also F. C. Stern, New Flora & Silva 10: 105–107. fig. 33. 1938). However, clonal plants of this putative hybrid that I have seen growing in England fall into the range of variation encountered in *M. wilsonii* and are similar to specimens of *M. wilsonii* collected in China. As a result, the name *M. × highdownensis* is placed in the synonymy of *M. wilsonii*.

An intentional interspecific hybrid, *Magnolia wilsonii* × *M. globosa*, has been produced as the result of deliberate cross-pollinations (see D. T. Gresham, Morris Arb. Bull. 17: 70–73. 1966). This hybrid is not described here, because I have not seen documenting herbarium specimens; nor do I have any record that the hybrids (F_1 generation) are grown within our area.

12. *M. sieboldii* K. Koch, Hort. Dendrol. 4. 1853. FIGURE 3, a–i.

Small deciduous trees to 10 m. or often large shrubs with several trunks from the base; branchlets slender, yellowish- or silvery-tan, sometimes becoming reddish-brown on exposed surfaces, at first thickly appressed-sericeous with silvery or $\pm$ rufous hairs or rarely subglabrous, eventually glabrous; terminal winter (mixed) buds finely appressed-pubescent to densely villous with tan or rufous hairs. Petioles slender, (0.8–)1.3–4.5(–5.5) cm. long, appressed-sericeous with silvery or sometimes rufous hairs, the stipule scars on the adaxial surfaces extending about half the lengths of the petioles, rarely longer; leaf blades elliptic, broadly elliptic, ovate, or characteristically broadly obovate, (5.5–)9–12(–16) cm. long, (3.4–)5.5–9.7 cm. wide, with broadly cuneate, rounded, $\pm$ truncate, or rarely subcordate bases, entire margins (sometimes ciliate when young), and acute to abruptly acute or short-acuminate apices; upper surfaces of the blades green, often with few, short hairs along the depressed midveins and prominent lateral veins, otherwise glabrous; lower surfaces of the blades glaucescent, rarely $\pm$ glabrescent, usually densely sericeous along the elevated midveins and major lateral veins when young and finely sericeous over the entire surface, the hairs $\pm$ straight, at least some or occasionally all with rusty-red pigment in the crosswalls. Flowers fragrant, cup-shaped at first, becoming $\pm$ saucer-shaped, appearing with the leaves, held nodding or $\pm$ pendent on slender, pubescent pedicels (2.5–)3–6(–7) cm. long; tepals 9–12, pure white, the outer 3 subequal to the inner ones, the inner tepals spatulate to broadly obovate, with rounded apices and cuneate to short-clawed bases, 3.5–6 cm. long, 2–4.4 cm. wide; stamens numerous, 10–15 mm. long, reddish-purple; gynoecia greenish, ca. 1.5 cm. long at anthesis. Fruit aggregates $\pm$ pendent, pinkish at dehiscence, becoming dark purplish-brown, cylindric, 2–7 cm. long, with short, $\pm$ erect styler beaks; seeds ca. 6 mm. long, the outer seed coats red. $2n = 38$. (*M. parviflora* Sieb. & Zucc., not Blume; *M. verecunda* Koidzumi.)

Native to a wide area of eastern Asia in Japan, Korea, and Manchuria; also known disjunctly from Anwhei and Kwangsi³ provinces, China.

Plants with the young branchlets tomentose with yellowish or $\pm$ rufous hairs, occasionally larger leaf blades to 21.5 cm. long and 15.9 cm. wide (some $\pm$ suborbicular), longer petioles to 6.4 cm. long, the stipule scars extending more than half the lengths of the petioles, and hairs on the lower surfaces of the leaf blades $\pm$ appressed and crinkled, lacking red or rust-colored pigment in the crosswalls are recognized here as *Magnolia sieboldii* subsp. *sinensis* (Rehder & Wilson) Spongberg, comb. et stat. nov. (BASIONYM: *Magnolia globosa* Hooker f. & Thompson var. *sinensis* Rehder & Wilson, Pl. Wilsonianae 1: 393. 1913; syn. *M. sinensis* (Rehder & Wilson) Stapf, Bot. Mag. 149: sub t. 9004. 1924; *M. nicholsoniana* Hort., not Rehder & Wilson).

This subspecies is apparently endemic to a small area of northwestern Szechwan Province, China, where the type specimens, *Wilson* 1422 (A, five sheets!; K, three sheets!), were collected west of and near Wen-ch'uan at 2,000 to 2,600 m. by E. H. Wilson in June and September of 1908. First proposed as a variety of *Magnolia globosa*, subsp. *sinensis*, $2n = 38$, has been recognized by most authors as a distinct species closely related to both *M. globosa* and *M. wilsonii*. However, during this study it was concluded that the closest affinities of the Szechwan plants are with *M. sieboldii* and that this relationship is best reflected by treating the taxon as a subspecies of *M. sieboldii*. This conclusion became inevitable when a comparison was made between one collection of *M. sieboldii* subsp. *sieboldii* from a plant cultivated on Martha's Vineyard, Massachusetts, *Spongberg & Hill* 74-14 (AAH), and the flowering specimens constituting the type collection of *M. globosa* var. *sinensis*. The flowering specimens of these two collections could well have come from a single gathering. Only after an examination and comparison of these collections with a series of specimens of *M. sieboldii* subsp. *sieboldii* (of both spontaneous and cultivated origin) were differences noted which distinguish the two taxa. The fact that subsp. *sieboldii* is wide-ranging in nature while subsp. *sinensis* is widely disjunct and apparently restricted to a small area of northwestern Szechwan Province suggests that the species once was more widely distributed and that the Szechwan population(s) has become morphologically differentiated as a result of geographic isolation.

Magnolia $\times$ *wieseneri* (q.v.) is a hybrid between *M. sieboldii* and *M. hypoleuca* occasionally cultivated in western gardens and arboreta, while *M. sieboldii* $\times$ *M. tripetala* is represented in cultivation by the cultivar 'Charles Coates', described briefly under *M. tripetala*.

³I have been unable to locate any earlier mention of the occurrence of *Magnolia sieboldii* in Kwangsi Province. It is credited here to that province on the basis of two specimens, *Z. S. Chung* 82074, Chuen Yuen, June 20, 1937 (A), and *Z. S. Chung* 83515, without precise locality or date (A).

MAGNOLIA subg. YULANIA (Spach) Reichenbach, Rep. Herb. Nomencl.
Gen. Pl. (Deutsche Bot.) 1(1): 192. 1841.

Deciduous trees and shrubs; flowers precocious or appearing with the leaves; tepals subsimilar or the outer whorl reduced in size and sepaloid; anther sacs laterally or sublaterally dehiscent.

Three sections, one with species in eastern North America and eastern Asia, two with species restricted to eastern Asia.

KEY TO THE SPECIES AND SELECTED HYBRIDS OF
MAGNOLIA SUBG. YULANIA IN CULTIVATION

1. Tepals subequal, the outer whorl petaloid, not simulating a calyx; flowers precocious, sometimes continuing to flower as the leaves expand; tepals white to purple. 2.
2. Tepals (12-)15-33, narrowly oblong or strap-shaped, 0.6-1.4(-1.7) cm. wide. 20. *M. kobus* var. *stellata*.
2. Tepals (5-)6-12(-16), spatulate to obovate or oblanceolate, (1.4-)2.5-7.5(-8) cm. wide. 3.
3. Tepals of the innermost whorl held erect, connivent, enclosing the androecium and gynoecium, the outer whorls held $\pm$ horizontally or occasionally reflexed; leaf blades generally elliptic to oblong-ovate, with 12 or more pairs of major lateral veins. 4.
4. Tepals 12-16; fruit aggregates 11-15(-20) cm. long; upper surfaces of the leaf blades glabrous. 13. *M. campbellii*.
4. Tepals 7-10; fruit aggregates 7-10 cm. long; upper surfaces of the leaf blades with short hairs along the veins. 26. *M. \times veitchii*.
3. Tepals of the innermost whorl not connivent, not enclosing the androecium and gynoecium, the outer whorls held $\pm$ horizontally or drooping; leaf blades generally obovate to oblanceolate, with 12 or fewer pairs of major lateral veins. 5.
5. Flowers held $\pm$ erect on the branchlets; leaves usually obovate to oblanceolate, apically acute or usually abruptly short-acuminate. 6.
6. Tepals or tepal scars 9, the tepals tapering downward to broad bases. 7.
7. Flowers precocious; tepals white, the outer whorl subequal to the inner whorls. 14. *M. heptapeta*.
7. Flowers precocious, sometimes continuing until after the leaves have expanded; tepals rarely white throughout, the abaxial surfaces usually flushed pink to dark purple, the outer whorl of tepals often ca. half as long as the inner tepals. 27. *M. \times soulangiana*.
6. Tepals or tepal scars 12 or more, the tepals tapering downward to relatively narrow, $\pm$ clawed bases. 8.
8. Tepals rosy-red on the abaxial surfaces; leaves generally less than twice as long as broad. 15. *M. sprengeri* var. *sprengeri*.
8. Tepals white on the abaxial surfaces; leaves generally more than twice as long as broad. 15. *M. sprengeri* var. *elongata*.

5. Flowers held $\pm$ horizontally on the branchlets; leaves usually obovate to oblanceolate, with rounded or sometimes emarginate apices. 9.
9. Tepals (10-)12-16, purplish-pink on the abaxial surfaces; leaf blades finely reticulate, the lower surfaces finely pubescent over the lamina or adjacent to the midveins. 10.
10. Tepals 12-14, 6.4-9 cm. long; leaf blades generally less than twice as long as broad. 16. *M. sargentiana* var. *sargentiana*.
10. Tepals 10-16, 8.4-12.5 cm. long; leaf blades generally more than twice as long as broad. 16. *M. sargentiana* var. *robusta*.
9. Tepals 9-12, pale pink on the abaxial surfaces; leaf blades strongly reticulate, the lower surfaces glabrous or with few, scattered hairs along the veins. 17. *M. dawsoniana*.
1. Tepals very unequal, the outer whorl sepaloid, simulating a calyx, sometimes caducous; flowers precocious or appearing with the leaves; petaloid tepals white, purplish, greenish, or yellowish. 11.
11. Flowers precocious; petaloid tepals white, sometimes flushed pink to purple at the base, or the tepals pink to purple. 12.
12. Flowers often continuing after the leaves have expanded; petaloid tepals flushed pink to purple on the abaxial surfaces, white to pink or purplish within. 13.
13. Shrubs; flowers continuing to appear with the leaves; stipule scars extending almost to the base of the blades, the lamina often decurrent along the petiole; leaf blades with hairs along the midveins or glabrous beneath. 21. *M. quinquepeta*.
13. Large shrubs or usually trees; flowers primarily precocious, some flowers appearing with the leaves; stipule scars small, basal, the lamina not decurrent along the petiole; leaf blades usually puberulent over the lower surfaces. 27. *M. × soulangiana*.
12. Flowers not continuing after the leaves have expanded; petaloid tepals white on both surfaces, sometimes tinged pink to purple basally, rarely with the abaxial surfaces flushed pink throughout. 14.
14. Petaloid, inner tepals (5-)6-16, spatulate, obovate or oblanceolate, (1.4-)2-4.5 cm. wide, the outer whorl of sepaloid tepals persistent at anthesis; young branchlets glabrous or finely sericeous. 15.
15. Lower surfaces of the leaf blades finely puberulent over the entire surface or at least adjacent to the midveins. 16.
16. Flowers held $\pm$ erect on the branchlets; petaloid tepals 6, $\pm$ erect; branchlets finely sericeous. 18. *M. cylindrica*.
16. Flowers held $\pm$ horizontally on the branchlets; petaloid tepals 6, rarely to 12, $\pm$ drooping; branchlets glabrous. 19. *M. salicifolia*.
15. Lower surfaces of the leaf blades glabrous or with long hairs scattered along the veins and/or in the axils of the midveins and major lateral veins. 17.
17. Petaloid tepals (5)6 or 7. . . 20. *M. kobus* var. *kobus*.

17. Petaloid tepals (11)12-16. 20. *M. kobus* var. *loebneri*.
 14. Petaloid tepals (12-)15-33, narrowly oblong or strap-shaped,
 0.6-1.4(-1.7) cm. wide, the outer whorl of sepaloid tepals
 often caducous or sometimes abortive; young branchlets finely
 sericeous. 20. *M. kobus* var. *stellata*.
 11. Flowers appearing with the expanded leaves; tepals purplish, greenish,
 or yellowish. 18.
 18. Large shrubs; petaloid tepals purplish. 21. *M. quinquepeta*.
 18. Large trees or rarely shrubs; petaloid tepals greenish to golden
 yellow. 19.
 19. Branchlets of the current and previous year glabrous; pedi-
 cels glabrous or rarely villous; tepals greenish-yellow through-
 out or sometimes golden yellow on the adaxial surfaces.
 22. *M. acuminata* var. *acuminata*.
 19. Branchlets of the current and previous year with short hairs
 or roughened by hair bases; pedicels villous or rarely gla-
 brous; tepals light yellow on the abaxial surfaces, golden yel-
 low within, rarely greenish-yellow throughout.
 22. *M. acuminata* var. *subcordata*.

MAGNOLIA sect. YULANIA (Spach) Dandy, Camellias and Magnolias,
 Roy. Hort. Soc. Conf. Rep. 72. 1950.

Deciduous trees and shrubs; flowers precocious; tepals subsimilar, not
 differentiated into an outer, sepaloid whorl and inner, petaloid whorls.
 TYPE SPECIES: *M. heptapeta* (Buc'hoz) Dandy (syn. *M. denudata* Des-
 rouss.).

More than seven species, all of eastern Asiatic distribution, of which
 five are known in cultivation. Although the section is well defined, species
 of sect. YULANIA are in need of more study. Despite importation of lim-
 ited quantities of seed, several species of the section are variable in
 cultivation. Because knowledge of several of these species in nature is
 based on limited herbarium material (in some instances only the type
 collections), it is to be expected that further knowledge of variation in
 nature might result in taxonomic changes.

13. *M. campbellii* J. D. Hooker & T. Thomson, Fl. Indica 1: 77. 1855.
 FIGURE 4, a.

Large deciduous trees with grayish-tan bark, often with several boles
 from near the base, in nature to 30 (or 45?) m., or occasionally large
 shrubs (*vide* G. Forrest); branchlets slender to $\pm$ stout, yellowish-green
 or greenish-tan, becoming dark reddish-brown, glabrous, lenticellate;
 terminal winter (mixed) buds ovoid, finely sericeous to densely woolly
 with yellowish-white hairs, the vegetative buds finely sericeous or sub-
 glabrous. Leaves variable, subcoriaceous, the petioles (0.8-)1-5 cm. long,
 glabrous, finely pubescent, or occasionally finely pubescent only at the
 distal end, with small basal stipule scars on the adaxial surfaces; leaf

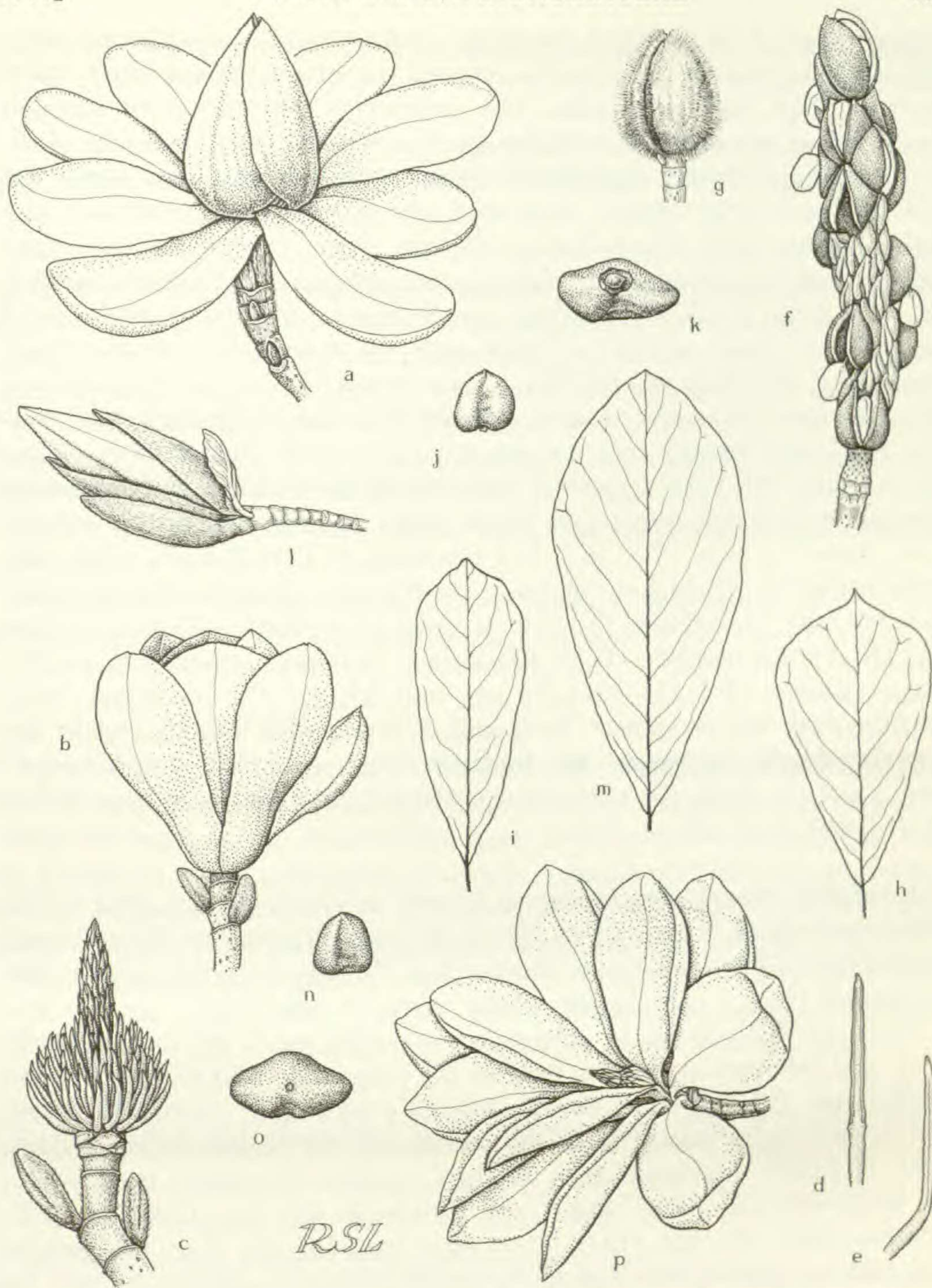


FIGURE 4. *Magnolia* sect. *Yulania*. a, flower of *M. campbellii* with connivent inner tepals, $\times \frac{1}{3}$. b-f, *M. heptapeta*: b, flower, $\times \frac{1}{2}$; c, flower with tepals removed to show the androecium and gynoecium, $\times \frac{3}{4}$; d, adaxial view of stamen, $\times 1\frac{1}{2}$; e, lateral view of stamen showing lateral line of anther sac dehiscence, $\times 1\frac{1}{2}$; f, fruit aggregate, $\times \frac{1}{2}$. g-k, *M. sprengeri*: g, terminal winter bud, $\times 1\frac{1}{2}$; f, fruit aggregate, $\times \frac{1}{2}$. g-k, *M. sprengeri*: g, terminal winter bud, $\times 1\frac{1}{2}$; h, outline of typical leaf of var. *sprengeri*, $\times \frac{1}{3}$; i, outline of typical leaf of var. *elongata*, $\times \frac{1}{3}$; j, seed with outer seed coat removed, $\times 1$; k, view of micropylar end of seed showing basal pore with stalk, $\times 2$. l-o, *M. sargentiana*: l, terminal floral bud enclosed by spathaceous stipular bracts, $\times \frac{1}{3}$; m, outline of typical leaf, $\times \frac{1}{3}$; n, seed with the outer seed coat removed, $\times 1$; o, view of micropylar end of seed showing basal pore, $\times 2$. p, habit of flowering branchlet of *M. dawsoniana*, $\times \frac{1}{3}$.

blades (8–)11.5–23.5(–33.5) cm. long, (3.8–)4.6–10.7(–14.5) cm. wide, elliptic, oblong-ovate or broadly obovate to oblong-ob lanceolate, with acute to short-acuminate apices and rounded to cuneate, often unequal bases; upper surfaces of the blades dark green, reticulate, glabrous; lower surfaces pale green, completely glabrous, finely velutinous along the midveins and major lateral veins or finely appressed-sericeous over the entire surface with silvery hairs. Flowers large, faintly fragrant, precocious, held erect on stout, glabrous or sometimes pubescent pedicels ca. 2 cm. long; tepals 12–16, deep to pale crimson or pink on the abaxial surfaces, the inner surfaces suffused with the same color, or the tepals pure white, the outer whorls held $\pm$ horizontally or occasionally reflexed and drooping, the tepals concave, broadly spatulate to oblong-ovate, usually constricted basally into a short claw, (6.5–)9.5–14 cm. long, (2.2–)4.2–6.2 cm. wide, the innermost whorl held erect, connivent, enclosing the androecium and gynoecium, these tepals broadly obovate to subglobose, clawed at base, (7.7–)8.5–10.3 cm. long, (3.5–)4.3–6 cm. wide; stamens numerous, (1–)1.5–3 cm. long, the filaments purplish-red; gynoecia 2–3 cm. long at anthesis, the carpels glabrous or finely sericeous, greenish, the stigmas reddish. Fruit aggregates held erect, eventually pendulous, cylindric, (7.5–)11–15(–20) cm. long when fully developed, often asymmetrical and/or shorter from seed abortion, dull pinkish-red at dehiscence, finally brownish, the follicles indiscrete prior to dehiscence; seeds ca. 1 cm. long, the outer seed coats red, the inner seed coat with a small basal pore. $2n = 114$.

A variable species, spectacular in bloom, native to a wide area of the Himalayan region from eastern Nepal through Bhutan, northern Assam, southeastern Tibet, and Upper Burma into Yunnan Province, China; unfortunately, hardy only in the milder areas of our range.

Plants of this species in cultivation are apparently derived primarily from seed collected at the two ends of the range, i.e., Sikkim and Yunnan (Johnstone, 1955, p. 47). George Forrest's collections from the eastern end of the range, mostly from the vicinity of the Shweli-Salwin Divide, were originally proposed as a distinct species, *Magnolia mollicomata* W. W. Smith, Notes Roy. Bot. Gard. Edinburgh 12: 211. 1920, but J. E. Dandy (*Ibid.* 16: 123, 124. 1928) later pointed out that the eastern and western plants were linked by intermediate populations in the intervening range, and on this basis he submerged *M. mollicomata* within *M. campbellii*. However, recognition of the Yunnan plants at some rank under *M. campbellii* may be justified, since they can usually be distinguished by their densely yellowish-sericeous or felted pedicels, their branchlets with persistent pubescence along one or two internodes beneath terminal stipular bud scale scars, and their elongate mixed (floral) buds. In cultivation, the Yunnan plants grown from Forrest's seed collections, while variable, are hardier than typical *M. campbellii* and commence to produce flowers at an earlier age. Although a larger series of specimens than I have seen from native habitats will be required to assess

and fully understand the variation of *M. campbellii* over its wide range, those plants from the eastern end of that area with the above mentioned characteristics have previously been recognized under *M. campbellii* as var. *mollicomata* (W. W. Smith) F. Kingdon-Ward, Gard. Chron. III. 137: 238. 1955, or as *M. campbellii* subsp. *mollicomata* (W. W. Smith) Johnstone, Asiatic Magnolias Cult. 53. 1955.

Like other species of sect. YULANIA, numerous plants of *Magnolia campbellii* grown from imported Asian seed or seed collected from plants grown in western gardens have proven variable in flower size, shape, and color, in leaf size, shape, and pubescence, and in their period of blooming. Owing to the great beauty of several distinctive plants in cultivation, they have been given cultivar names; reference should be made to Fogg and McDaniel (1975) for a listing of the cultivars and to D. T. Gresham (Morris Arb. Bull. 15: 29-31. 1964) and E. McClintock (Jour. Calif. Hort. Soc. 23: 30-36. 1962) for more detailed information concerning a number of these variants.

Magnolia $\times$ *veitchii* (q.v.) is the collective epithet for hybrids between *M. campbellii* and *M. heptapeta*. Crosses between the two varieties of *M. campbellii*, sometimes referred to as *M. \times raffillii*, an illegitimate name (see N. G. Treseder, Newsl. Am. Magnolia Soc. 5: 7. 1968), have also been produced and are represented in cultivation by the cultivars 'Charles Raffill' (see Jour. Roy. Hort. Soc. 88: 494. figs. 173, 174. 1973) and 'Kew's Surprise' (*Ibid.* 92: 235. 1967). Trihybrids between *M. campbellii* and *M. \times soulangiana* have been produced in England but are known to me in cultivation in North America only outside our range, at the Strybing Arboretum. Furthermore, the cultivar 'Caerhays Surprise' (see F. J. Williams, Jour. Roy. Hort. Soc. 99: 364, 365. fig. 173. 1974) represents the results of intentional hybridization between *M. campbellii* (as var. *mollicomata*) and *M. quinquepeta* 'Nigra' (as *M. liliflora*). This hybrid is not known by me to be grown in the United States.

14. *M. heptapeta* (Buc'hoz) J. E. Dandy, Jour. Bot. 72: 103. 1934.
FIGURE 4, b-f.

Twiggy deciduous trees to ca. 15 m., usually of $\pm$ rounded habit, or occasionally large shrubs; bark dark gray, rough and fissured; branchlets stout, lenticellate, finely to densely sericeous, soon glabrous, reddish- or purplish-brown, eventually silvery-gray; vegetative buds finely pubescent, the terminal winter (mixed) buds densely sericeous with silvery-gray or yellowish hairs. Petioles 1.3-2 cm. long, finely tomentose, with small basal stipule scars on the adaxial surfaces; leaf blades membranaceous, 6.5-13.5(-15) cm. long, 4.6-8.5(-11.2) cm. wide, rarely elliptic or broadly obovate to subrounded, usually obovate to oblong-obovate, tapering to cuneate, obtuse, or subrounded, rarely $\pm$ truncate bases, the distal ends $\pm$ rounded or truncate, usually produced into abruptly short-acuminate apices, the margins entire; upper surfaces of the blades dark green, $\pm$ reticulate, sparingly pubescent along the major veins, oc-

casionally along the secondary veins; lower surfaces $\pm$ reticulate, light green, puberulent along the veins. Flowers lemony-fragrant, precocious, $\pm$ vase-shaped, held erect on short, densely yellowish-villous pedicels; tepals 9 (or rarely 12), subsimilar, white or ivory, sometimes tinged purplish at the base on the abaxial surfaces, broadly spatulate to obovate, with rounded or $\pm$ acute apices, (4.8–)7–8.5 cm. long, 2.5–4.5 cm. wide; stamens numerous, purplish, 7–11 mm. long, the connectives produced into short, apiculate appendages; gynoecia greenish, ca. 2 cm. long at anthesis, thin, spindle-shaped. Fruit aggregates cylindric, often asymmetrical from seed abortion, (4.5–)7–15 cm. long, greenish-pink at dehiscence, becoming brownish, the follicles rounded and discrete prior to dehiscence, lacking styler beaks; seeds 10–13 mm. long, the outer seed coats red, the inner ones black, $\pm$ heart-shaped, with an apiculate apex. $2n = 114$. (*Lassonia heptapeta* Buc'hoz, *M. denudata* Desrouss., *M. conspicua* Salisb., *M. yulan* Desf., *M. precia* Loisel.) — YULAN, LILY-TREE.

Widely cultivated in China and Japan; judged to be native to eastern China in Kiangsu, Anhwei, Chekiang, Kiangsi, and Hunan provinces (see P. J. Savage, Jr., Newsl. Am. Magnolia Soc. 10(2): 3–9. 1974).

The plants referred to by Rehder (1940, p. 251) as *Magnolia denudata* var. *purpurascens* (Maxim.) Rehder & Wilson, Pl. Wilsonianae 1: 401. 1913, excluding the Chinese plant, are apparently not cultivated in North America (*vide* Fogg & McDaniel, 1975), at least under that varietal name. Moreover, the status of these plants is questionable, since Yasui (1937) reported their chromosome number as $2n = 95$, while that of *M. heptapeta* is $2n = 114$. Makino, in treating these plants as a distinct species, *M. purpurascens* (Maxim.) Makino, Jour. Jap. Bot. 6(4): 8. 1929, suggested that they may represent hybrids between *M. heptapeta* and *M. quinquepeta*, in which case the plants would fall under the hybrid group *M. $\times$ soulangiana* (q.v.).

15. *M. sprengeri* Pampanini, Nuovo Gior. Bot. Ital. 22: 295. 1915.

FIGURE 4, g–k.

Deciduous trees to 20 m., often of slender pyramidal habit; bark light tannish-gray, smooth and lenticellate, in old plants exfoliating in small flakes; branchlets stout to $\pm$ slender, yellowish-green or yellowish-tan, becoming dark purplish-gray and longitudinally fissured, often finely sericeous for 2 or 3 internodes beneath flowers or fruit aggregates of the current or past seasons, otherwise glabrous; terminal winter (mixed) buds finely sericeous to densely woolly with yellowish-white hairs. Petioles 1.5–2.5 cm. long, completely glabrous or occasionally villous at the base of the blades and on the abaxial surfaces opposite the small, adaxial stipule scars; leaf blades 7–13.5(–17) cm. long, 3.8–7(–12) cm. wide, generally less than twice as long as broad, obovate or rarely ovate or broadly elliptic, with cuneate to rounded bases, distally rounded to $\pm$

truncate, the apices abruptly short-acuminate or rarely rounded; upper surfaces of the blades green, glabrous or with scattered hairs appressed along the midveins and major lateral veins, finely reticulate; lower surfaces pale green, reticulate, glabrous or finely appressed-puberulent over the entire surface, or occasionally glabrous except for crisped hairs along the midveins and in the axils of the midveins and major lateral veins. Flowers precocious, fragrant, saucer-shaped, held erect on short glabrous or densely yellowish-sericeous pedicels, the pubescent pedicels soon glabrous; tepals 12(-14), subsimilar, broadly spatulate to oblong-obovate, (4.7-)5.5-12 cm. long, (2.2-)2.5-5.2(-6.5) cm. wide, the abaxial surfaces rosy-red, the adaxial surfaces rosy-red to pale pink; stamens numerous, 10-15 mm. long, rosy-red; gynoecia spindle-shaped, ca. 2 cm. long at anthesis, greenish, the stigmas rosy-red. Fruit aggregates cylindric, often asymmetrical from seed abortion, 6-13 cm. long, the follicles rounded and $\pm$ discrete prior to dehiscence, green, becoming dull pink at dehiscence, finally brownish; seeds ca. 1 cm. long, with red outer seed coats, the inner seed coats with a basal pore surrounding a small stalk. $2n = 114$. (*M. denudata* var. *purpurascens* (Maxim.) Rehder & Wilson, excluding synonyms; *M. diva* Stapf ex Millais; including *M. sprengeri diva* Stapf, *M. sprengeri* var. *diva* Stapf ex Johnstone).

Native to Honan, Hupeh, and Szechwan provinces, China.

Small bushy trees, apparently to 15 m. in nature, or large shrubs, $2n = 114$, with the leaves 10.7-14.5 cm. long, 4.1-5.8 cm. wide, oblong-ob lanceolate, and usually more than twice as long as broad, and with slightly smaller flowers comprised of white tepals (sometimes tinged with pink) are referable to *Magnolia sprengeri* var. *elongata* (Rehder & Wilson) Johnstone, Asiatic Magnolias Cult. 87. 1955 (*M. denudata* var. *elongata* Rehder & Wilson, *M. sprengeri elongata* (Rehder & Wilson) Stapf), of Hupeh and Szechwan provinces, China.

As is well documented by Stapf (Bot. Mag. 152: sub t. 9116. 1926) and reviewed by Johnstone (1955, pp. 79-89; see also P. J. Savage, Jr., Newsl. Am. Magnolia Soc. 6(2): 1-5. 1969), there have been considerable nomenclatural and taxonomic difficulties concerning *Magnolia sprengeri* and its subspecific division. Some of this confusion exists because it cannot be determined which of the two customarily recognized varieties of *M. sprengeri* corresponds to the typical variety, var. *sprengeri*. This situation results because the type material of *M. sprengeri*, collected by P. C. Silvestri in northern Hupeh in 1912 and 1913, consists only of flowering specimens, and it is not possible to determine the original color of the dried tepals. Furthermore, since the flowers of *M. sprengeri* are precocious, the specimens lack leaves.

As a result, I am provisionally and arbitrarily designating plants with rosy-red tepals and leaves that are less than twice as long as broad as comprising var. *sprengeri*, while maintaining var. *elongata* for plants with white tepals and leaves generally more than twice as long as broad. This procedure has been adopted previously (see Hilliers' Man. ed. 3, p. 184.

1973), and judging from Wilson's notes (Pl. Wilsonianae 1: 402. 1913) on the relative abundance of the two varieties in nature, it might be expected that Silvestri's collections were from rosy-red-flowered plants. If, however, it were subsequently determined that Silvestri's specimens correspond to var. *elongata*, the correct varietal name for plants with rosy-red flowers would be var. *diva* Stapf ex Johnstone, Asiatic Magnolias Cult. 83. 1955.

The plant figured and discussed by Stapf in the Botanical Magazine under *t.* 9116 was one of several plants grown from seed collected in China by Wilson. These plants were initially grown by the Veitch nursery firm in England but were sold in 1913 at the famous Coombe Wood sale to Kew, Caerhays Castle in Cornwall, and Bodnant in northern Wales. Although the entire seed lot (W-688) was ascribed by Wilson to var. *sprengeri* (cited as *M. denudata* var. *purpurascens* (Maxim.) Rehder & Wilson), the plants proved to be variable, and all but one plant at Caerhays (the plant figured in Bot. Mag.) produced white flowers and are referable to var. *elongata*. Apparently, the Caerhays plant represents the only introduction of var. *sprengeri*, and its clonal and seed progeny represent the variety in cultivation in western gardens. As a result of its great horticultural value, the Caerhays plant of *M. sprengeri* var. *sprengeri* and its clonal progeny are usually referred to by the cultivar name 'Diva'. For detailed descriptions of this cultivar, reference should be made to Stapf's article and to that of Johnstone (1955, pp. 83-86, *pl.* 9).

16. *M. sargentiana* Rehder & Wilson, Pl. Wilsonianae 1: 398. 1913.

FIGURE 4, 1-0.

Deciduous trees, in nature to ca. 25 m., usually of upright habit, the bark light tannish-gray, warted with conspicuous lenticels, in old plants fissured into irregular platelets; branchlets stout to $\pm$ slender, yellowish-green or yellowish-tan, becoming reddish-brown, often with conspicuous whitish lenticels, finely sericeous for 2 or 3 nodes beneath the flowers or fruit aggregates of the current or past seasons, otherwise glabrous; terminal winter (mixed) buds densely woolly with yellowish-white hairs, the vegetative buds finely sericeous to subglabrous. Petioles 1.5-4.5 cm. long, glabrous or with very few scattered hairs, the adaxial surfaces with small basal stipule scars; leaf blades subcoriaceous, (7-)11-18 cm. long, (4.6-)5-10.5(-12) cm. wide, generally less than twice as long as broad, obovate to oblanceolate or broadly elliptic, rarely $\pm$ suborbicular, with cuneate, often unequal bases and acute to rounded or sometimes emarginate apices; upper surfaces of the blades light green, $\pm$ glossy, reticulate, glabrous; lower surfaces paler green, finely pubescent over the entire surface or on the lamina adjacent to the midveins with $\pm$ appressed, curly, silvery or grayish hairs. Flowers fragrant, precocious, $\pm$ nodding on short, glabrous to densely sericeous pedicels; tepals subsimilar, 12-14, rarely fewer, 6.4-9 cm. long, 1.4-3.4 cm. wide, spatulate or oblong-

oblanceolate, purplish-pink on the abaxial surfaces, white to pale pink on the adaxial surfaces; stamens numerous, 12–18 mm. long, purplish; gynoecia greenish, with purplish styles, narrowly cylindric, (2–) 2.5–3 cm. long at anthesis. Fruit aggregates cylindric, 9–11 cm. long, often asymmetrical and contorted from seed abortion, reddish-purple at dehiscence, finally dark purplish-brown; follicles $\pm$ discrete prior to dehiscence, with obsolete styler beaks; seeds ca. 1 cm. long, the outer seed coats orangish-red, the inner seed coat with a small basal pore. $2n = 114$. — SARGENT'S MAGNOLIA.

Native to northern Yunnan, Szechwan, and eastern Sikang provinces, China.

Spreading bushy trees usually branched from near the base, with oblanceolate leaves 14.5–20.5(–25) cm. long, 5.9–8.7(–13.5) cm. wide, and more than twice as long as broad, producing larger flowers with (10–)12–16 obovate tepals 8.4–12.5 cm. long and (3.1–)4.5–7.5(–8) cm. wide and larger fruit aggregates 15–19.5 cm. long have been segregated as *Magnolia sargentiana* var. *robusta* Rehder & Wilson, Pl. Wilsonianae 1: 399. 1913. Known only from the type locality (woodlands and open country, Washan) in western Szechwan, var. *robusta*, $2n = 114$, is known to me from E. H. Wilson's type collection and from specimens of cultivated plants apparently grown from his seed collection or their progeny.

The cultivar 'Caerhays Belle' (see F. J. Williams, Jour. Roy. Hort. Soc. 91: 285. fig. 151. 1966) represents *Magnolia sargentiana* var. *robusta* $\times$ *M. sprengeri* 'Diva', while 'Buzzard' and 'Hawk' are selections from *M. sargentiana* var. *robusta* $\times$ *M. campbellii*. Specimens or plants of these hybrids have not been seen.

17. *M. dawsoniana* Rehder & Wilson, Pl. Wilsonianae 1: 397. 1913.

FIGURE 4, p.

Deciduous trees to ca. 12 m. or usually large shrubs of $\pm$ dense, twiggy growth, the bark $\pm$ smooth, tannish-gray, lenticellate; branchlets slender to $\pm$ stout, yellowish-green, becoming dark reddish-brown, lenticellate, glabrous or finely sericeous for 1 or 2 internodes beneath the flowers; terminal winter (mixed) buds finely appressed-pubescent with yellowish or silvery hairs. Petioles 1.3–2.9 cm. long, glabrous or finely pubescent within the small, basal stipule scars; leaf blades $\pm$ subcoriaceous, 7.5–13.5 cm. long, 5–7.8 cm. wide, broadly elliptic or usually obovate, tapering to cuneate to subrounded, usually unequal bases, the distal ends usually obtuse, rounded, or $\pm$ truncate, the apices sometimes abruptly short-acuminate, rarely emarginate; upper surfaces of the blades lustrous dark green, strongly reticulate, finely pubescent along the midveins, sometimes becoming glabrous; lower surfaces paler green, strongly reticulate, glaucous(?), glabrous or with few scattered hairs along the midveins. Flowers fragrant, precocious, held $\pm$ horizontally or nodding at the ends of branchlets on stout, glabrous or pubescent pedicels 7–15 mm. long; tepals 9–12, subsimilar, oblong-spatulate to oblanceolate, 7–11(–12.7)

cm. long, 2.1–5(–6.5) cm. wide, white, the abaxial surfaces flushed pale pink; stamens numerous, purplish-red, 12–18 mm. long; gynoecia narrowly cylindric, at anthesis ca. 1.5 cm. long. Fruit aggregates cylindric, 7–10 cm. long, sometimes asymmetrical from seed abortion, reddish-green at dehiscence, becoming dark reddish-brown; follicles rounded and discrete prior to dehiscence, lacking stylar beaks; seeds 7–10 mm. long, the outer seed coats red, the inner black seed coat with a basal pore surrounding a small stalk. $2n = 114$. — DAWSON'S MAGNOLIA.

Known only from the type locality near Tatsien-lu in eastern Sikang Province (formerly in western Szechwan Province), China; very infrequently cultivated in our area.

Closely allied to *Magnolia sargentiana*, *M. dawsoniana* differs from that species in the essentially glabrous under surfaces of its more strongly reticulated leaves, in its flowers with fewer tepals, in its usual shrublike habit, and in the different structure at the base of the inner seed coats.

MAGNOLIA sect. BUERGERIA (Siebold & Zuccarini) Dandy, Camellias and Magnolias, Roy. Hort. Soc. Conf. Rep. 73. 1950.

Deciduous trees and shrubs; flowers precocious; the outer whorl of tepals sepaloid, sometimes caducous, rarely abortive, the inner whorls petaloid. TYPE SPECIES: *M. stellata* Sieb. & Zucc. = *M. kobus* var. *stellata* (Sieb. & Zucc.) Blackburn.

Four species of China and Japan. With the exception of *Magnolia biondii* Pampanini of Shensi, western Honan, western Hupeh, and eastern Szechwan provinces, China, all the species of this section are cultivated in western gardens.

18. *M. cylindrica* E. H. Wilson, Jour. Arnold Arb. 8: 109. 1927.

Small trees to ca. 9 m., with smooth, silvery-gray or tannish bark; young branchlets reddish- or purplish-brown, densely but finely silvery-pubescent, eventually glabrous, emitting a spicy odor when bruised; terminal winter (mixed) buds villous, the hairs yellowish or silvery, the vegetative buds with shorter and fewer hairs. Petioles (9–)12–20(–25) mm. long, finely appressed-pubescent and narrowly grooved along the length of the adaxial surfaces to the basal stipule scars; leaf blades membranaceous to subcoriaceous, (5.7–)8–13.5 cm. long, 1.6–4.8[–6.5] cm. wide, elliptic to oblong-elliptic, [obovate, or oblanceolate], with acute to rounded apices and cuneate to attenuate bases; upper surfaces of the blades glabrous, dark shining green; lower surfaces $\pm$ pulverulent to glaucous, finely appressed-puberulent over the surface and along the midveins, occasionally becoming glabrous; in herbarium material the veins of the leaves elevated above the lamina on the upper and particularly the lower surfaces. Flowers [precocious, similar to flowers of *M.*

heptapeta in shape, held erect] on densely silky-pubescent pedicels at the ends of branchlets, [usually subtended by an expanding leaf at anthesis]; tepals [dimorphic, the outer 3 small, membranaceous, sepaloid, 12–15 mm. long, ca. 4 mm. wide], the inner 6 [petaloid, (6.5–)8–10 cm. long, (2.5–)3.5–4(–4.5) cm. wide, broadly spatulate to obovate, white, tinged pink at the base on the adaxial surfaces, the innermost tepals held $\pm$ erect until late during anthesis; androecia ca. 13 mm. high, the stamens with broad, flattened, pinkish filaments and acute to rounded apices; gynoecia ca. 1.2 cm. long at anthesis, barely extending beyond the stamens, cylindric-ovoid, greenish]. Fruit aggregates 5–7.5 cm. long, cylindric, 1.8–2.5 cm. in diameter, $\pm$ pendent, greenish, tinged purplish or reddish prior to follicle dehiscence, [becoming dark purplish-black on the exterior, the inner follicle walls tan; seeds ca. 1 cm. long, irregularly 2- or 3-faceted]. [$2n = 38$.]

Known with certainty only from the type locality in Anwhei Province, China, where specimens studied by E. H. Wilson were collected by R. C. Ching (*Ching* 2949, A, two sheets!, K!; 2994, A!, K!) on Wang Shan in 1925. J. E. Dandy, in an annotation on one of these sheets, states that *Ching* 2501 from northern Fukien near the Chekiang border is also this species.

Seed, reputedly of *Magnolia cylindrica*, was received in 1936 by the late Mrs. J. Norman Henry of Gladwyne, Pennsylvania, from the Lu Shan Botanic Garden, and plants considered to be *M. cylindrica* now in cultivation in the United States and England are undoubtedly directly or indirectly derived from this original importation. However, the identity and status of the plants now being grown has been questioned, particularly since *M. cylindrica* was based on specimens with immature fruit aggregates, and no flowering material of the species has been examined from China (see J. C. McDaniel, "*Magnolia cylindrica*," the Chinese puzzle, *Newsl. Am. Magnolia Soc.* 10: 3–7. 1974; N. G. Treseder, *Magnolia cylindrica*, *Rhododendrons* 1975, with *Magnolias* and *Camellias*, *Roy. Hort. Soc.* 70–72. 1975).

Because of the questionable identity of plants now in cultivation as *Magnolia cylindrica*, the description given here is based on a re-examination of the type material in the herbaria at the Arnold Arboretum and at Kew, while supplemental information based on specimens from the plants in cultivation is included within brackets. A comparison of the protologue and the description presented here (based on the type specimens) will show some discrepancies, particularly concerning the texture of the leaves, a character that has been interpreted to be at variance between the plants in cultivation and the leaves described by Wilson. My comparisons of the type material and specimens of the cultivated plants⁴ have satisfied me, however, that the leaves as well as other

⁴The following specimens of *Magnolia cylindrica* from cultivation have been studied (all at AAH): *Witt s.n.*, Univ. Washington Arb., Acc. #741–49, foliage, 3 July 1959; *Krossa s.n.*, Hort. Krossa, Livonia, Michigan, foliage and fruit aggregate,

characters are in agreement. The status of *M. cylindrica* as a distinct species or, as suggested by McDaniel, a putative hybrid involving *M. heptapeta* as one parent cannot be answered until sufficient material, particularly from China, is available for an assessment of variability. The hybridization studies suggested by McDaniel may give interesting results and insights helpful to the determination of the correct taxonomic status of *M. cylindrica*, a taxon that is accepted here provisionally as a species.

19. *M. salicifolia* (Siebold & Zuccarini) Maximowicz, Bull. Acad. Sci. St. Pétersb. 17: 419. 1872. FIGURE 5, o, p.

Large deciduous shrubs or usually small, often slender pyramidal or occasionally widely branching trees to 12 m.; bark warted, dull silvery- or brownish-gray, the young branchlets slender, lenticellate, yellowish-green, becoming dark reddish- or purplish-black, usually emitting a lemony or aniselike odor when bruised; terminal winter (mixed) buds densely villous with long silvery or yellowish hairs, the vegetative buds yellowish or blackish, finely sericeous or with few, short, scattered hairs, occasionally glabrate. Petioles yellowish, (7-)12-20 mm. long, narrowly winged above the basal stipule scars, occasionally puberulent; leaf blades (4-) 6.5-12(-16) cm. long, (1.7-)2-5.5(-7) cm. wide, ovate to elliptic or usually lanceolate or oblong-lanceolate, broadest at or below the middle, with acute or rounded apices, irregularly wavy margins, and cuneate, acute, or subrounded, often $\pm$ unequal bases; upper surfaces of the blades dull green, glabrous or rarely puberulent, particularly along the midveins; lower surfaces pale green, often $\pm$ glaucous, very finely and inconspicuously puberulent over the entire surface or at least adjacent to the elevated, often yellowish midveins. Flowers usually fragrant, precocious, held $\pm$ horizontally at the ends of branchlets on glabrous to sparingly villous pedicels, often subtended by an expanding leaf; tepals dimorphic, the outer 3 (rarely more) small, sepaloid, oblong, up to 3.5 cm. long and 1 cm. wide, thin, greenish-white, the inner tepals 6 or occasionally 7 or 8 (rarely to 12), petaloid, white, sometimes greenish or flushed pink at the base on the abaxial surfaces, broadly spatulate, obovate, or oblanceolate in outline, (3.7-)5-9(-12) cm. long, 2-4(-4.5) cm. wide; androecia ca. 1.5 cm. high, the stamens whitish, often pinkish at base, with deltoid to rounded apices; gynoecia 1-1.5 cm. high, green, the styles whitish, slightly recurved. Fruit aggregates cylindric, (3-)4.5-6(-7.5) cm. long, usually symmetrical or occasionally asymmetrical and curved from follicle abortion, at first held $\pm$ erect, green, becoming dull pink to reddish as the follicles dehisce, finally dark purplish-black; seeds

12 Aug. 1965; Segel & Thompson 211, Arnold Arb., Acc. #2111-65, plant from Hillier, flowering specimens, 6 May 1975; Spongberg & Lancaster s.n., Hilliers' Jermyns Gardens & Arboretum, foliage and immature fruit aggregates, 10 June 1975. Plants have also been seen at the Henry Foundation for Botanical Research, Gladwyne, Pennsylvania, and the Strybing Arboretum.

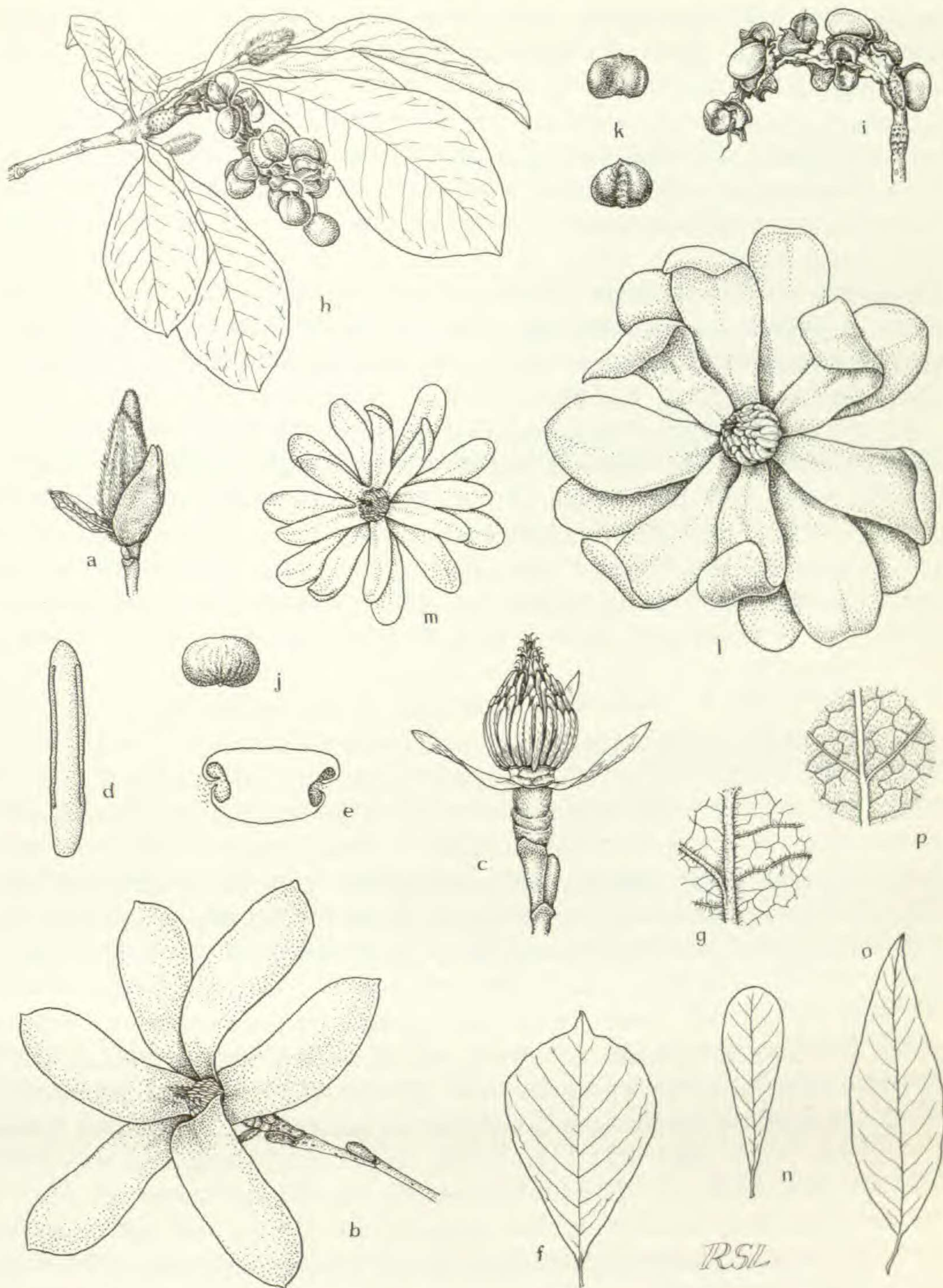


FIGURE 5. *Magnolia* sect. *Buergeria*. a-k, *M. kobus* var. *kobus*: a, terminal winter (mixed) bud, $\times \frac{1}{2}$; b, habit of flowering branchlet, $\times \frac{1}{2}$; c, flower, the inner petaloid tepals removed to show androecium and gynoecium, $\times 1$; d, adaxial view of stamen, $\times 3$; e, transverse section of stamen showing sublateral dehiscence of anther sacs, $\times 12$; f, outline of typical leaf, $\times \frac{1}{3}$; g, detail of lower surface of leaf blade showing pubescence along major lateral veins and midvein, $\times 3$; h, habit of branchlet with fruit aggregate, $\times \frac{3}{8}$; i, fruit aggregate with dehiscent follicles, $\times \frac{1}{2}$; j, seed with outer seed coat intact, $\times \frac{3}{4}$; k, seeds with the outer seed coats removed, $\times \frac{3}{4}$. l, flower of *M. kobus* var. *loebneri* 'Merrill', $\times \frac{1}{2}$. m, n, *M. kobus* var. *stellata*: m, flower, $\times \frac{1}{2}$; n, outline of typical leaf, $\times \frac{1}{3}$. o, p, *M. salicifolia*: o, outline of typical leaf, $\times \frac{1}{3}$; p, detail of lower surface of leaf blade showing puberulence, $\times 3$.

ca. 8 mm. long, the outer seed coats red. $2n = 38$. (*Buergeria salicifolia* Sieb. & Zucc., *Talauma? salicifolia* (Sieb. & Zucc.) Miquel; including *M. salicifolia* var. *fasciata* Millais, *T. salicifolia* β *concolor* Miquel, *M. \times proctoriana* Rehder, *M. \times slavinii* Harkness, and putative hybrids between *M. salicifolia* and *M. kobus* var. *kobus* given the binomial *M. \times kewensis* S. A. Pearce, an invalid name lacking a Latin description.) — ANISE MAGNOLIA, WILLOW-LEAF MAGNOLIA.

Endemic to the Japanese islands of Honshu, Shikoku, and Kyushu, where it occurs at moderate elevations in *Fagus* and *Quercus* forests. (See Map 119 in H. Hara & H. Kanai, Distribution maps of flowering plants in Japan. Fasc. 2. Tokyo. 1959.)

Despite the fact that *Magnolia salicifolia* is relatively variable and very closely related to *M. kobus*, it is easily distinguished from that species by the shape and pubescence of its leaves. *Magnolia salicifolia* was originally introduced into western horticulture by C. S. Sargent, but it has been questioned whether the plants grown and distributed by the Arnold Arboretum from Sargent's seed collections were typical *M. salicifolia* (see B. Blackburn, *Baileya* 5: 6. 1957; W. J. Bean, 1973, pp. 661, 662). Probably as a result of the skepticism surrounding the original plants and the lack of sufficient knowledge of the variability of *M. salicifolia* in nature, several plants of *M. salicifolia* that appeared as seedlings in cultivation were recognized as hybrids, and numerous plants now in cultivation are currently treated as belonging to hybrid groups. In two of the three instances in which putative hybrids were described, it was postulated that other taxa of sect. *BUERGERIA* were the pollen parents. Thus Rehder described a hybrid between *M. salicifolia* and *M. kobus* var. *stellata* (pro. sp.), giving the name *M. \times proctoriana* to the hybrid group (Jour. Arnold Arb. 20: 412. 1939), while S. A. Pearce (Gard. Chron. III. 132: 154. 1952) gave the collective name *M. \times kewensis*⁵ to presumed hybrids between *M. salicifolia* and *M. kobus* var. *kobus*. A third hybrid originally assumed to involve *M. salicifolia* as the seed parent and *M. \times soulangiana* as the pollen parent was named *M. \times slavinii* Harkness (Natl. Hort. Mag. 33: 118. 1954). However, this hybrid was later (Morris Arb. Bull. 12: 19. 1961) reduced to the synonymy of *M. \times proctoriana*, since its chromosome number, $2n = 38$, did not coincide with the number to be expected had *M. \times soulangiana*, $2n = 95, 114$, been the pollen parent.

However, a re-examination of the morphology of the three presumed hybrids (including the type specimens of *Magnolia \times proctoriana* and

⁵ The original plant of this putative hybrid and its clonal progeny are now generally known under the cultivar name 'Kewensis'. An alternative designation utilizes the formula *M. salicifolia* $\times$ *M. kobus* to cover all progeny of this cross, but if Blackburn's taxonomy (1955, 1957) is adopted concerning *M. kobus* and its varieties, as it is here, the name *M. \times proctoriana*, as a collective epithet, covers all hybrids between *M. salicifolia* and *M. kobus*. For reasons discussed above, however, these hybrids are repudiated and the name *M. \times proctoriana* is placed in the synonymy of *M. salicifolia*.

specimens from the "type" plants of *M. × slavinii* and *M. × kewensis*) and that of the assumed parental taxa has convinced me that the "hybrids" are easily accommodated within *M. salicifolia*. This conclusion is supported when the variation of *M. salicifolia* in nature is studied in conjunction with the cultivated material. The fact that seedlings of *M. salicifolia* show a degree of variability is undoubtedly correlated to some extent with the fact that the species is self-compatible (see J. C. McDaniel, Newsl. Am. Magnolia Soc. 2: 4. 1965), and plants grown from self-fertilized seeds should be expected to exhibit variation associated with the expression of recessive traits. Support for the nonhybrid status of these plants also comes from the cytological condition found in plants grown as *M. × proctoriana*. F. S. Santamour, Jr. (Morris Arb. Bull. 21: 80. 1970) found that at meiosis "pairing at metaphase I was regular, with 19 bivalents being formed. Pollen abortion was only 7% and the grains averaged 36.9 μ in diameter."

Among the cultivars of *Magnolia salicifolia*, 'Slavin's Snowy' (see B. Harkness, Morris Arb. Bull. 12: 19. 1961) and 'Wada's Memory' (see B. Mulligan, Arb. Bull. 22: 20, 21. 1959) are of particular merit because of their abundant large flowers.

20. *M. kobus* De Candolle, Reg. Veg. Syst. Nat. 1: 456. 1817.

FIGURE 5, a-n.

Deciduous shrubs or usually trees to 20 m., the trees occasionally with a single bole, often with several limbs from near the base and widely branching; bark warted, dull to clear silvery or brownish-gray, becoming $\pm$ ridged on old trunks; young branchlets slender to $\pm$ stout, glabrous or occasionally finely sericeous, lenticellate, yellowish-green, becoming dark reddish or purplish-black, usually emitting a turpentinelike odor when bruised; terminal winter (mixed) buds densely villous with long silvery or yellowish-brown hairs, the vegetative buds usually blackish, occasionally yellowish or greenish, finely to densely sericeous. Petioles yellowish-green, (0.1-)1-2.5(-3) cm. long, narrowly winged or shallowly grooved along the length of the adaxial surfaces above the basal stipule scars; leaf blades (3.2-)4.5-14.5(-16.5) cm. long, (2.5-)4-8.3 (-9.5) cm. wide, rarely elliptic, usually obovate to oblanceolate, widest at or above the middle, with acute, abruptly short-acuminate, or occasionally rounded apices, $\pm$ wavy, often undulate margins, and attenuate to cuneate, often oblique, bases; upper surfaces of the blades dark green, glabrous; lower surfaces pale green, glabrous or with long hairs scattered along the elevated veins and in the axils of the midveins and major lateral veins. Flowers precocious, usually $\pm$ fragrant, held $\pm$ horizontally at the ends of branchlets on finely to densely pubescent pedicels, usually subtended by an expanding leaf at anthesis; tepals dimorphic, the outer 3 (rarely more) small, sepaloid, persistent at anthesis, oblong, (0.6-)1.5-3.5(-4) cm. long, (0.2-)0.3-0.5(-1) cm. wide, usually greenish- or brownish-white, rarely pure white, the inner tepals usually 6, sometimes 5 or 7, petaloid, white, usually suffused with pink at the base on

the abaxial surface, (5-)6-7(-9.8) cm. long, (1.3-)2-3.5(-4.2) cm. wide, narrowly to broadly spatulate to oblanceolate or sometimes obovate in outline; androecia ca. 1.5 cm. long, the stamens usually pinkish or purplish at base; gynoecia 1-1.5 cm. long at anthesis, cylindric, green, the styles whitish. Fruit aggregates held $\pm$ horizontally, cylindric and symmetrical or often curved, asymmetrical and constricted between some follicles owing to seed abortion, 3.5-11 cm. long, green at first, becoming pinkish or reddish at dehiscence, warted with whitish outgrowths, finally reddish-brown; seeds ca. 9 mm. long, usually slightly wider, with red outer seed coats. $2n = 38$. (*M. thurberi* Parsons; *M. praecocissima* Koidzumi; including *M. kobus* var. *borealis* Sarg.) — KOBUS MAGNOLIA.

Relatively common at moderate elevations throughout Japan; also known from Quelpaert Island, South Korea.

As is well outlined by Johnstone (1955, pp. 92-94), the rationale for the inclusion of var. *borealis* Sarg., Trees & Shrubs 2: 57. 1908, within var. *kobus* is based on the fact that there are no clear-cut distinguishing characters that separate the northern plants from the southern ones.

Aside from *Magnolia kobus* var. *kobus*, above, two additional, horticulturally important varieties of *M. kobus* are recognized here; the status accepted for var. *stellata* follows the treatment proposed by Blackburn (Baileya 5: 3-13. 1957).

Magnolia kobus var. *stellata* (Sieb. & Zucc.) Blackburn, Amatores Herbarii 17: 1. 1955 (*Buergeria stellata* Sieb. & Zucc.; *Magnolia stellata* (Sieb. & Zucc.) Maxim.; *M. halleana* Parsons; *M. kobus* f. *stellata* (Sieb. & Zucc.) Blackburn; including *M. stellata* var. *rosea* Veitch, *M. stellata* var. *keiskei* Makino), $2n = 38$, Star magnolia, is distinguished from var. *kobus* by its habit as a low, twiggy shrub or small tree with finely sericeous young branchlets, its narrower, elliptic or usually obovate to oblanceolate leaf blades (1.8-)6-13.2 cm. long and (0.8-)2.5-6.5 cm. wide, with rounded, obtuse, acute, or abruptly short-acuminate apices, and its flowers with numerous (12-33), narrowly oblong, petaloid tepals 0.6-1.4(-1.7) cm. wide and 4-6.5 cm. long, sometimes suffused with pink on the abaxial surfaces. The outermost whorl of three small sepaloid tepals in flowers of var. *stellata* is often caducous, falling with the stipular bud scales as the flowers expand, or sometimes it is abortive. A Japanese plant, var. *stellata* has a reputedly natural area of distribution in the mountains of the western Tōkaidō District of southern Honshu. It has been questioned, however, whether this taxon actually occurs or did occur in the spontaneous flora of Japan or whether it was of garden origin (see N. G. Treseder, Newsl. Am. Magnolia Soc. 8(2): 8. 1972). The question is perhaps justified, since var. *stellata* is widely grown in Japan as an ornamental, and the few records of its occurrence as a wild plant are questionably valid.

Among the cultivars of *Magnolia kobus* var. *stellata*, several are of particular horticultural interest. These include 'Royal Star', a very hardy upright small tree that blooms later in spring than most plants of var. *stellata*, with the flowers, as a result, less subject to frost damage; 'Rosea'

(= *M. stellata* var. *rosea* Veitch, Jour. Hort. Soc. London 27: 865. fig. 196. 1902), with the tepals suffused with reddish pink on the abaxial surfaces in bud, fading to near white during anthesis; 'Centennial' (see Avant Gard. 5(24): 1. 1973), with larger and more numerous pure white tepals than are found in most clones; and 'Waterlily', another clone of vigorous and fast-growing plants with water-lilylike flowers, pinkish in bud.

An F_1 generation of sterile, triploid hybrids, $2n = 57$, between *Magnolia kobus* var. *stellata* and *M. quinquepetala* (as *M. liliflora*) that are multiple-stemmed, rounded or conical shrubs with erect terminal winter (mixed) buds, glabrous branchlets, *quinquepetala*-like leaves, and *stellata*-like flowers has been produced at the United States National Arboretum, and eight named cultivars selected from these hybrids have been distributed to several arboreta and commercial nurseries. The cultivars, 'Ann', 'Betty', 'Jane', 'Judy', 'Pinkie', 'Randy', 'Ricki', and 'Susan', are fully described by T. R. Dudley and W. F. Kosar (Morris Arb. Bull. 19: 26-29. 1968; *Ibid.* 20: 64, 65. 1969).

Intraspecific hybrids between *Magnolia kobus* var. *kobus* and *M. kobus* var. *stellata* have resulted from deliberate and chance crosses, and owing to the desirability of a name for these horticulturally important plants, the hybrid group is recognized here as *M. kobus* var. *loebneri* (Kache) Sponberg, comb. et stat. nov. (BASIONYM: *Magnolia* $\times$ *loebneri* Kache, Gartenschönh. 1: 20. 1920). Plants of var. *loebneri* are generally small trees and occasionally shrubs with young branchlets sparingly sericeous; variable leaf blades narrowly oblanceolate to obovate, broadly elliptic or oblong, 6.5-14.3 cm. long, 2.3-6.1 cm. wide, the apices obtuse, rounded, or abruptly short-acuminate, rarely $\pm$ retuse; and flowers held $\pm$ horizontally and comprised of 3 outer, sepaloid tepals and 11-16 narrowly to broadly spatulate petaloid tepals (1.3-)1.6-3 cm. wide and 5-7.9 cm. long, the abaxial surfaces sometimes flushed pink. This hybrid group was first recognized as the result of deliberate crosses made between var. *kobus* and var. *stellata* by Max Löbner of Pillnitz, Germany, shortly before World War I. Additional intentional crosses have been made, while chance crosses in cultivation have been recognized, and several of the exceptional progeny have received cultivar names. The most outstanding cultivars include 'Merrill' (see D. Wyman, Arnoldia 12: 45. pl. 12. 1952), 'Spring Snow', and 'Ballerina' (for both see J. C. McDaniel, Newsl. Am. Magnolia Soc. 7(1): 1-3. 1970), all with large, exceptionally showy white flowers, and 'Leonard Messel' (see Jour. Roy. Hort. Soc. 94: 522. 1969; Newsl. Am. Magnolia Soc. 9(1): 6, 7. 1973), with lilac-pink flowers.

MAGNOLIA sect. TULIPASTRUM (Spach) Dandy, Camellias and Magnolias, Roy. Hort. Soc. Conf. Rep. 74. 1950.

Deciduous trees and shrubs; flowers occasionally precocious (but then continuing with the leaves), usually appearing with the leaves; outer

whorl of tepals sepaloid, sometimes caducous, the inner petaloid tepals greenish to yellow or purple. TYPE SPECIES: *M. acuminata* L.

Two species, one of eastern North America and the second widely cultivated since ancient times in China and Japan, judged to be native to China.

21. *M. quinquepeta* (Buc'hoz) Dandy, Jour. Bot. 72: 103. 1934.

Deciduous shrubs with grayish bark, to ca. 3 m., occasionally larger, spreading or upright, usually $\pm$ straggly in habit, sometimes suckering from the roots; branchlets green, becoming purplish-brown, glabrous, sparingly lenticellate; terminal winter (mixed) buds finely but densely sericeous with yellowish or silvery hairs, becoming narrow and $\pm$ sickle-shaped when expanding, the vegetative buds finely sericeous. Petioles 1–2 cm. long, finely sericeous, with elongate, pubescent stipule scars extending almost to the base of the leaf blades; leaf blades broadly elliptic to oblong-obovate or oblanceolate, (10–)13–20 cm. long, (4.5–)6.5–10 (–11.5) cm. wide, tapering $\pm$ gradually to acute to rounded, rarely abruptly short-acuminate apices and cuneate to attenuate bases, the lamina usually decurrent along the petiole to the stipule scar; upper surfaces of the blades dark green, finely pubescent along the midveins, otherwise glabrous or with few, scattered hairs over the lamina; lower surfaces pale green, glabrous or sometimes with hairs along the midveins, rarely with hairs over the lamina. Flowers sometimes precocious, but continuing after the leaves have expanded, often with a second period of bloom in fall, $\pm$ vase-shaped, odorless or faintly fragrant, held $\pm$ erect on stout, sericeous pedicels; tepals dimorphic, the outer whorl of 3 or 4 sepaloid, 2–3.5 cm. long, 5–7(–10) mm. wide, greenish or purplish, caducous, the inner tepals 6(–10), petaloid, narrowly lanceolate to spatulate, (6.5–)8–10(–13) cm. long, (2–)3–4.5(–5.1) cm. wide, the abaxial surfaces purplish, the adaxial surfaces whitish to light purple; stamens 8–10 mm. long, purplish, the connectives produced into short, acute appendages; gynoecia ca. 1.5 cm. long at anthesis, the carpels purplish. Fruit aggregates apparently rarely formed, those examined cylindric to subglobose, 3.5–5.5 cm. long, dark purplish-brown; follicles rounded prior to dehiscence, with short styler beaks; seeds ca. 1 cm. long. $2n = 76$. (*Lawsonia quinquepeta* Buc'hoz; *M. liliflora* Desrouss. in Lamarck; *M. obovata* Thunberg, quoad syn.; *M. discolor* Ventenat; *M. purpurea* Curtis; *M. denudata* Schneider, not Desrouss.)

Cultivated in China and Japan since ancient times but judged to be native to China, "probably of the warm temperate districts south of the Yangtze river" (Rehder & Wilson, Pl. Wilsonianae 1: 403. 1913).

Several cultivars of *Magnolia quinquepeta* have been named (see J. C. McDaniel, Newsl. Am. Magnolia Soc. 9(2): 20–23. 1973; Fogg & McDaniel, 1975), and the following two were accounted for by Rehder

(1940, 1949): 'Nigra' (= *M. liliflora* var. *nigra* (Nicholson) Rehder in Bailey, Std. Cycl. Hort. 4: 1968. 1916; *M. × soulangiana nigra* Nicholson, Gard. 25: 276, 277. pl. 434, 1884), a plant with large flowers, the petaloid tepals ca. 12 cm. long, intensely dark purple abaxially, light purple within; 'Gracilis' (= *M. liliflora* var. *gracilis* (Salisbury) Rehder in Bailey, Std. Cycl. Hort. 4: 1968. 1916; *M. gracilis* Salisbury, Parad. Londin. 2: t. 87. 1807), a small shrub with narrow leaves and small, dark purple flowers. It would appear that these cultivar names have been used for several similar clones, and it is probably impossible to distinguish the direct clonal progeny of the plants to which these names were originally applied.

Magnolia quinquepeta is the pollen parent of the hybrid group *M. × soulangiana* (q.v.), while triploid hybrids between *M. kobus* var. *stellata* and *M. quinquepeta*, $2n = 57$, have been produced at the United States National Arboretum and are discussed briefly under *M. kobus*. *Magnolia quinquepeta* 'Nigra' (as *M. liliflora* var. *nigra*) is also the pollen parent of *M. × brooklynensis* Kalmbacher (Newsl. Am. Magnolia Soc. 8(2): 7, 8. 1972; *Ibid.* 9(1): 12, 13. 1973), $2n = 78$, a hybrid group involving *M. acuminata* as the seed parent. The type clone of this hybrid group is 'Evamaria', while J. C. McDaniel has introduced another cultivar, 'Woodsman' (see Newsl. Am. Magnolia Soc. 9(1): 13, 14. 1973; *Ibid.* 10(2): 23. 1974; Am. Horticulturist 54(1): 10-13. 1975). *Magnolia × brooklynensis*, as well as *M. quinquepeta × M. sprengeri*, *M. quinquepeta × M. campbellii*, and the trihybrids between *M. quinquepeta* and *M. × veitchii* (see D. T. Gresham, Morris Arb. Bull. 13: 47-50. 1962), is not described here, since documenting herbarium specimens and/or living plants have not been seen.

22. *M. acuminata* (Linnaeus) Linnaeus, Syst. Nat. ed. 10. 2: 1082. 1759.

Large deciduous trees usually of pyramidal form, to 30 m., the brownish-gray bark furrowed into ridges; branchlets reddish-brown, becoming silvery-tan, lenticellate, sometimes pubescent at the nodes, otherwise glabrous; terminal winter (mixed) buds finely sericeous with closely appressed, silvery hairs. Petioles (1.5-)2.5-3.5(-5) cm. long, with basal stipule scars, silvery-sericeous, sometimes becoming subglabrous; leaf blades ± membranaceous, elliptic to broadly ovate, oblong-ovate, or occasionally oblong-obovate, 10-24 cm. long, with acute to abruptly acuminate or sometimes obtuse apices and rounded or truncate to acute or cuneate, often unequal bases; upper surfaces of the blades dark green, sparingly puberulent over the surface, becoming glabrous; lower surfaces paler green, ± glaucous, finely puberulous to densely sericeous, particularly adjacent to the veins, sometimes becoming subglabrous. Flowers appearing with the leaves, ± cup-shaped, held ± erect on glabrous or occasionally densely villous pedicels 1.5-3 cm. long; tepals 9, greenish to greenish-yellow throughout, sometimes purplish-tinged, glau-

cous, the outer whorl of 3 smaller than the inner 6, sepaloid, ca. 2 cm. long, becoming reflexed, the inner tepals petaloid, 3–9(–10) cm. long, 1–3 cm. wide, oblanceolate to oblong-spatulate; stamens numerous, ca. 1 cm. long, the filaments well defined; gynoecia ca. 2.5 cm. long at anthesis. Fruit aggregates $\pm$ ovoid to oblong-cylindric, often asymmetrical from seed abortion, (3–)3.5–5(–7) cm. long, green, becoming pinkish at dehiscence, finally dark reddish-brown; follicles rounded, lacking stylar beaks; seeds 9–11 mm. long, the outer seed coats reddish-orange. $2n = 76$. (*M. virginiana* ϵ *acuminata* L.; *Tulipastrum acuminatum* (L.) Small; including *M. acuminata* var. *ludoviciana* Sarg., *M. acuminata* var. *ozarkensis* Ashe.) — CUCUMBER-TREE.

A variable species widely distributed in eastern North America from southern Ontario and New York southward to Alabama, Mississippi, and Louisiana, and west to Arkansas and eastern Oklahoma. (See E. L. Little, Jr., *Atlas of U. S. Trees* 1: *map* 140-*E*. 1971; J. C. McDaniel, *Newsl. Am. Magnolia Soc.* 9(2): 9–14. 1973; *Ibid.* 10(2): 21, 22. 1974.)

Plants with the outer petaloid tepals greenish-yellow and the inner petaloid tepals clear golden yellow have been recognized as *Magnolia acuminata* f. *aurea* (Ashe) Hardin, *Jour. Elisha Mitchell Sci. Soc.* 70: 306. 1954 (*Tulipastrum acuminatum* var. *aureum* Ashe). This yellow-flowered form of *M. acuminata* occurs sporadically in the mountains and upper Piedmont of the Carolinas, Georgia, and Tennessee, while plants comprising *M. acuminata* var. *subcordata* (Spach) Dandy, *Am. Jour. Bot.* 51: 1056. 1964 (*Tulipastrum americanum* var. *subcordatum* Spach; *M. cordata* Michx.; *M. acuminata* var. *cordata* (Michx.) Sarg.; including *M. acuminata* var. *alabamensis* Ashe), also commonly with yellow flowers, are native to the Piedmont and Coastal Plain from central North Carolina to central Alabama. Usually trees or sometimes large shrubs, plants of var. *subcordata* are distinguished from plants of var. *acuminata*, described above, by the young branchlets densely sericeous with close, silvery hairs or at least roughened by the bases of these hairs, the lower surfaces of the leaf blades closely tomentose, and the yellow or sometimes greenish-yellow flowers borne on densely villous, rarely glabrous, pedicels. As noted by Hardin (1954), intermediates between the two varieties occur, and reference should be made to Hardin's paper for a more detailed and complete comparison of the two taxa.

The hardiest of the America species of *Magnolia*, *M. acuminata* is often used as rootstock for grafting other, more tender species. *Magnolia acuminata* is also the seed parent of hybrids with *M. quinquepeta*, known under the collective epithet *M. $\times$ brooklynensis*; these are discussed briefly under *M. quinquepeta*.

HYBRIDS

23. *M. virginiana* Linnaeus $\times$ *M. grandiflora* Linnaeus.

Evergreen or sometimes deciduous trees to 10 m. (perhaps more), of spreading or erect, columnar habit; branchlets stout, with septate pith, at first thickly to thinly felted with rufous or yellowish hairs, the older growth eventually glabrous, green or yellowish-green, becoming reddish-brown; buds densely sericeous with rufous or silvery-rufous hairs. Petioles stout, (1-)1.5-2(-2.5) cm. long, densely sericeous with rufous hairs, the density often decreasing with age, with small, often obscured, pubescent, basal stipule scars on the adaxial surfaces; leaf blades stiffly coriaceous, 8.8-18(-22) cm. long, 4-8.5(-10) cm. wide, elliptic, oblong-lanceolate, $\pm$ oblong-ovate to broadly ovate, with attenuate bases, entire $\pm$ undulate margins, tapering slightly to rounded or rarely retuse apices; upper surfaces of the blades dark, glossy green, at first with hairs scattered over the lamina and on the midveins, the hairs along the midveins often persistent, the lamina, when dried, finely reticulated in a $\pm$ honeycomb pattern; lower surfaces $\pm$ glaucous, often densely felted with rufous or silvery-rufous hairs, often less densely so in age. Flowers cup-shaped, lemony-fragrant, occurring intermittently throughout the growing season, borne erect on densely silvery-, yellowish-, or rufous-felted pedicels 1-2 cm. long; tepals 9-12(?), white, broadly spatulate to subglobose in outline, 5.5-9 cm. long, 2.7-5.5 cm. wide; stamens ca. 12 mm. long, numerous, rosy-purple; gynoecia ca. 2 cm. long at anthesis, carpels finely pubescent, the styles glabrous. Fruit aggregates rarely developed, when formed often asymmetrical, $\pm$ subglobose, ca. 4 cm. long, the follicles finely sericeous; seeds not seen. $2n = 76$.

As noted by O. M. Freeman (Natl. Hort. Mag. 16: 161, 162. 1937) when he first described this hybrid group, which resulted from cross-pollinations made by him in 1930 and 1931, plants of this parentage resemble *Magnolia grandiflora*, the pollen parent, more closely than *M. virginiana*, the seed parent. Two cultivars have been selected from these hybrids and represent the group in cultivation. 'Freeman' (see U. S. D. A. plant inventory no. 169, P. I. 277263; F. G. Meyer, Newsl. Am. Magnolia Soc. 8(1): 7, 8. 1971), a selection from the F_1 generation, is a plant of narrow columnar habit propagated fairly easily from vegetative cuttings of half-ripened wood. 'Maryland' (see F. G. Meyer, Newsl. Am. Magnolia Soc. 8(1): 8, 9. 1971), another selection from the F_1 generation, is a plant of spreading habit that was also named because of the relative ease with which its vegetative cuttings can be rooted.

Apparently the cultivar 'Griffin' (Fogg & McDaniel, 1975, p. 16) represents a spontaneous hybrid between *Magnolia virginiana* and *M. grandiflora*.

24. *M.* × *wieseneri* Carrière, Rev. Hort. 62: 406. 1890. [*Magnolia hypoleuca* × *M. sieboldii*.]

Small, deciduous, bushy trees or large shrubs to ca. 7 m., usually with long branchlets and of rather ungainly habit; branchlets ± stout, at first sparingly appressed-pubescent with silvery hairs, soon glabrous, green, becoming yellowish- or reddish-brown, the periderm exfoliating in thin sheets; terminal winter (mixed) buds ± glaucous, sparingly pubescent. Leaves alternate, the internodes at the ends of branchlets often short and the leaves in somewhat loose, false whorls; petioles slender to stout, (1.7–)2.4–3(–5.5) cm. long, subglabrous to finely sericeous with silvery hairs, the adaxial surfaces with prominent stipule scars; leaf blades (9.8–)13.8–19(–22) cm. long, (5–)7.4–10.5(–12.3) cm. wide, broadly elliptic to obovate, tapering to cuneate to acute, sometimes unequal bases and acute to rounded apices, the margins entire, often undulate; upper surfaces of the blades green, often with scattered hairs along the midveins and the 10–15 pairs of major lateral veins, otherwise glabrous; lower surfaces glaucous, finely sericeous along the elevated midveins and sparsely appressed-pubescent over the entire surface with ± straight or crisped hairs, usually with reddish pigment in the crosswalls. Flowers fragrant, ± cup-shaped, held erect on stout, glabrous or puberulent pedicels 3–8 cm. long; tepals 9, the outer whorl of 3 white tepals becoming ± reflexed and flushed pink in age, the inner 6 tepals creamy white, broadly obovate, with rounded apices and narrowed bases, 5.5–6 cm. long, 2–3.5 cm. wide; stamens numerous, rosy-crimson, 1.5–2 cm. long, the apices rounded, blunt, or occasionally apiculate; gynoecia ca. 3 cm. long at anthesis. Fruit aggregates and seeds not seen. $2n = 38$. (*Magnolia* × *watsonii* J. D. Hooker.)

A putative hybrid between *Magnolia hypoleuca* and *M. sieboldii*, apparently of garden origin in Japan. First introduced into western horticulture by the Japanese at the 1889 International Exposition in Paris, plants of this parentage have generally been known as *M.* × *watsonii* J. D. Hooker. However, Carrière's name for this hybrid group was published on 1 September 1890, while Hooker's description (Bot. Mag. 117: sub. t. 7157) is dated 1 February 1891, thus necessitating under the rule of priority the adoption of Carrière's name for all hybrids of this parentage.

The description given here has been based on five specimens, two of Japanese origin, including a 1918 Wilson collection from the grounds of the Yokohama Nursery Company, Ltd. While most closely resembling *Magnolia sieboldii*, *M.* × *wieseneri* can be readily distinguished from that species by several characters, including the greater number of major lateral veins in the leaf blades, the erect position of the flowers, the longer stamens, and the larger gynoecium. From *M. hypoleuca* the hybrids differ in habit, in the smaller leaves with fewer lateral veins, in the pubescent young branchlets, and in the smaller tepals.

25. *M. × thompsoniana* (Loudon) C. de Vos, Nederl. Fl. & Pomon. 131. t. 43. 1876. [*Magnolia virginiana* × *M. tripetala*.]

Usually deciduous or occasionally semievergreen shrubs or small trees to ca. 8 m., sometimes of loose, ungainly habit, reminiscent of *Magnolia virginiana*; branchlets yellowish-green, becoming reddish-brown, lenticellate; pith incompletely septate; terminal winter (mixed) buds greenish or yellowish-brown, glaucous. Leaves alternate, the internodes at the ends of branchlets often short and the leaves sometimes appearing to be in false whorls; petioles yellowish-green, (1.4–)1.8–2.5(–3.5) cm. long, finely puberulent along the length of the adaxial surface above the basal stipule scar; leaf blades elliptic or occasionally oblanceolate, (5.5–)12–17.5(–22) cm. long, (2.4–)5.5–7.5(–8.5) cm. wide, with entire, ± undulate margins, cuneate bases, and acute apices; upper surfaces of the blades green, shining, often with short hairs scattered along the midveins, otherwise glabrous; lower surfaces silvery- or grayish-green, glaucous, finely appressed-puberulous with silvery hairs over the entire surface, particularly along the elevated midveins. Flowers ± vase-shaped, pleasantly fragrant, held erect at the ends of branchlets on relatively stout, glaucous pedicels (1.5–)2.4–3.5 cm. long; tepals 9, the outer 3 greenish-white, spatulate in outline, with relatively broad bases, becoming ± reflexed, the inner 6 tepals creamy white, oblong-obovate, 7–9 cm. long, 2.4–3.5(–4) cm. wide, with rounded apices and narrowed, ± clawed bases; stamens 1–1.5 cm. long, the connectives produced into short, acute appendages; gynoecia greenish, ca. 2 cm. long at anthesis. Fruit aggregates 4–5 cm. long, cylindric, green, becoming pinkish; seeds not seen. $2n = 38$. (*M. glauca* var. *major* Sims; *M. glauca* var. *thompsoniana* Loudon.) — THOMPSON'S MAGNOLIA.

A chance hybrid between *Magnolia virginiana* and *M. tripetala* first described in 1820 (Bot. Mag. 47: t. 2164) from a plant grown from seed in the nursery of Archibald Thompson at Mile End, London, England. Plants of this parentage known to me in cultivation are in most characters intermediate between the two parental species. In habit they are perhaps most easily confounded with *M. virginiana*. However, the incompletely septate pith of branchlets of *M. × thompsoniana* contrasts with the distinctly and completely septate pith of *M. virginiana*; this character should aid in identification at any season of the year. This hybrid has recently been recreated as a result of intentional cross-pollinations of the parent species (see J. C. McDaniel, Illinois Research, Ill. Agr. Expt. Sta., pp. 8, 9. Fall, 1966), and the sterility of the hybrids has also been investigated (see F. S. Santamour, Jr., Morris Arb. Bull. 17: 29, 30. 1966).

Specimens that I have seen of hybrids between *Magnolia virginiana* and *M. hypoleuca*, mentioned under the latter species, are almost indistinguishable from specimens of *M. × thompsoniana*.

26. *M.* × *veitchii* auct. ex Gard. Chron. III. 69: 154. fig. 68. 1921; emend. J. W. Bean in Veitch, Jour. Roy. Hort. Soc. 46: 321. 1921. [*M. heptapeta* × *M. campbellii*.]

Vigorous deciduous trees to 30 m., when in flower similar in appearance to *M.* × *soulangiana*; bark ± smooth, lenticellate, silvery-tan, the branchlets glabrous or with few, scattered hairs, ± stout, dark purplish-brown, lenticellate. Petioles finely pubescent, 2.5–3 cm. long; leaf blades obovate to oblong, (11.5–)14.3–22 cm. long, (6.5–)8.6–11.6 cm. wide, abruptly short-acuminate or acute at the apices, the bases cuneate to ± rounded, unequal; upper surfaces of the blades dark green, with short hairs along the veins, otherwise glabrous; lower surfaces reticulate, finely sericeous along the mid and lateral veins, sometimes on the lamina as well. Flowers precocious, ± vase-shaped, held erect on stout, finely pubescent pedicels 1–1.4 cm. long; tepals 7–10, subequal, white flushed pink to purple on the abaxial surfaces, the adaxial surfaces very pale pink or whitish, or the tepals white on both surfaces, obovate to broadly spatulate, narrowed basally into a claw, (6.3–)9–12.2 cm. long, (2.5–)4.5–5.9 cm. wide, the inner tepals held ± erect, partially enclosing the androecium and gynoecium; stamens (1.3–)1.5–2.2 cm. long, purplish; gynoecia 1.8–2.3 cm. long at anthesis. Fruit aggregates 7–10 cm. long, cylindric, usually contorted and asymmetrical from seed abortion, pinkish-green at dehiscence, becoming dark purplish-brown; seeds with red outer seed coats, ca. 7 mm. long. $2n = 114(?)$. — VEITCH'S MAGNOLIA.

The name *Magnolia* × *veitchii* is applied to hybrids between *M. heptapeta* and *M. campbellii*. These hybrids were first obtained by P. C. M. Veitch in England in 1907. Of five plants grown from the original hybrid seed, one plant produced flowers with pinkish tepals, while the remaining four plants produced white flowers. The pink-flowered plant, the form most often encountered in cultivation, is known by the cultivar name 'Peter Veitch'.

27. *M.* × *soulangiana* Soulange-Bodin, Mém. Soc. Linn. Paris 1826: 269. 1826; Ann. Soc. Hort. Paris 1: 90. 1827. [*M. heptapeta* × *M. quinquepeta*.]

Deciduous trees or sometimes large shrubs, usually of densely twiggy habit; bark silvery-gray, ± smooth, with prominent horizontal lenticels; branchlets purplish-brown, ± stout, glabrous or at first finely appressed-pubescent; terminal winter (mixed) buds grayish, finely sericeous with yellowish or silvery hairs, the vegetative buds silvery-pubescent. Petioles 0.7–3 cm. long, stout, finely sericeous, with short, basal stipule scars on the adaxial surfaces; leaf blades membranaceous to ± subcoriaceous, broadly elliptic to oblong-oblongeolate or broadly obovate to suborbicular, usually abruptly short-acuminate (the apex itself rounded) or sometimes ± rounded, and tapering to cuneate to subrounded, often unequal bases, (5.5–)7.5–16.2(–22) cm. long, (2.8–)3.1–11.5(–12.5) cm. wide; upper

surfaces of the blades reticulate, dark, $\pm$ glossy green, with short, crisped hairs along the midveins and major lateral veins, sometimes with scattered hairs on the lamina as well; lower surfaces reticulate, paler green, with sericeous pubescence along the veins and not uncommonly puberulent over the lamina. Flowers precocious, often continuing until after the leaves have expanded, variable in size, shape, and coloring, generally goblet-, cup-, or saucer-shaped, fragrant or odorless, held $\pm$ erect on stout, densely sericeous pedicels 5–7 mm. long; tepals 9, white or white flushed or variously streaked pink to dark purple on the abaxial surfaces, the adaxial surfaces white to pinkish, subsimilar, the outer whorl sometimes ca. half the length of the inner tepals, 6–11(–15) cm. long, 2.7–7(–9) cm. wide, generally spatulate to obovate or oblanceolate, or rarely the outer whorl greenish and sepaloid, when present, ca. 4 cm. long, 1.2 cm. wide; stamens numerous, usually pinkish to purplish, 8–12(–15) mm. long; gynoecia 1.5–2 cm. long at anthesis. Fruit aggregates cylindric, 5–10(–11.5) cm. long, often contorted and asymmetrical from seed abortion, pinkish-green at dehiscence, finally dark reddish-purple; follicles rounded, lacking styler beaks; seeds ca. 12 mm. long, the outer seed coats red. $2n = 95, 114(?)$. (*M. speciosa* Van Geel; *M. conspicua* var. *soulangiana* Hort. ex Pampanini.) — SAUCER MAGNOLIA.

Perhaps the most widely cultivated *Magnolia* in western gardens, *M.* $\times$ *soulangiana* comprises a variable group of hybrids between *M. heptapeta* and *M. quinquepeta*, which were first grown by C. E. Soulange-Bodin of Fromont, France, in 1820, apparently as the result of deliberate cross-pollinations. Although partially sterile, a multitude of forms of *M.* $\times$ *soulangiana* have appeared in cultivation since that time, and it would appear that owing to segregation in the F_2 and succeeding generations and, perhaps, introgression, several forms approach or merge with *M. heptapeta*, the original seed parent, and *M. quinquepeta*. As a result, identification of particular plants is difficult, if not impossible, without knowledge of chromosome number, and a thorough investigation of *M.* $\times$ *soulangiana*, particularly in relation to *M. heptapeta*, is needed. Generally, plants of *M.* $\times$ *soulangiana* can be distinguished from *M. heptapeta* by their later blooming period (they begin to bloom one or two weeks after *M. heptapeta*), by the often continuous production of a few flowers until after the foliage has expanded, by the usual pink to purple coloration of the abaxial surfaces of the tepals, and by the generally larger size of the flowers. From *M. quinquepeta* the hybrids can be distinguished by their blooming period, by the usually petaloid outer whorl of tepals, by their mostly treelike habit, and by differences in the bases of the leaf blades.

Backcrosses between *Magnolia* $\times$ *soulangiana* and *M. quinquepeta* have been produced intentionally (represented in cultivation by cv. Dark Splendor, see Fogg & McDaniel, 1975), while successful pollinations have resulted in hybrids between *M.* $\times$ *soulangiana* and *M.* $\times$ *veitchii* as well (see D. T. Gresham, Morris Arb. Bull. 13: 48, 49. 1962).

Among the multitude of *Magnolia* $\times$ *soulangiana* cultivars, the following two were accounted for by Rehder (1940, 1949), are well known in cultivation, and are of historical interest: 'Lennei' (= *M.* $\times$ *soulangiana* var. *lennei* (Topf) Rehder in Bailey, Cycl. Am. Hort. 3: 966. 1901; *M. lenneana* Topf, Gartenflora 1: 86, 87; 244. 1852; see also N. Tresseder. Newsl. Am. Magnolia Soc. 6(2): 5, 6. 1969), $2n = 114$, a plant with large suborbicular leaves and large, tulip-shaped flowers comprised of fleshy, obovate tepals flushed rosy-purple on the abaxial surfaces, the outer whorl sometimes sepaloid; and 'Rustica Rubra' (= *M.* $\times$ *soulangiana* f. *rubra* (Nicholson) Rehder, Jour. Arnold Arb. 21: 276. 1940; var. *rustica* Rehder in Bailey, Std. Cycl. Hort. 4: 1969. 1916; *M. rustica rubra* Nicholson, Flora Sylva 1: 17 + pl. 1903), a plant thought to be a seedling of 'Lennei' with shorter, broader tepals flushed clear, rosy-red, not purplish. For descriptions of numerous other cultivars of *M.* $\times$ *soulangiana* reference should be made to Bean (1973, pp. 666–668), *Hilliers' Manual* (1973, pp. 183, 184), and the complete listing in Fogg and McDaniel (1975).

2. *Michelia* Linnaeus, Sp. Pl. 1: 536. 1753; Gen. Pl. ed. 5. 240. 1754.

Evergreen trees or shrubs similar to *Magnolia* in structure and appearance; buds enclosed by stipular scales, leaving annular scars on the branchlets. Leaves alternate, petiolate, stipulate, the stipules caducous, adnate to the petioles (leaving obscure to conspicuous scars on the adaxial surfaces of the petioles) or free; leaf blades coriaceous, with entire margins, cuneate to rounded bases, and obtuse, acute, or acuminate apices. Flowers usually fragrant, axillary, solitary, short to long-pedicellate. Perianth generally cup-shaped, comprised of 6–21 subsimilar (or rarely $\pm$ dimorphic) fleshy tepals, in bud enclosed by stipular scales. Stamens numerous, the filaments usually very short, hardly differentiated from the elongated connectives, the connectives usually produced into acute or acuminate appendages; anther sacs elongate, dehiscing laterally or sublaterally. Gynoecia conspicuously stipitate, of numerous carpels (or rarely reduced to a single carpel), the carpels with 2 or more ovules, the stigmatic surfaces decurrent along the stylar beaks. Fruits conelike aggregates of free and lax or occasionally concrescent, longitudinally dehiscent follicles. Seeds 2 or more per follicle, like those of *Magnolia*. (*Champaca* Adanson; *Liriopsis* Spach.) TYPE SPECIES: *M. champaca* L. (Name commemorating Peter A. Michel, 1679–1737, a Florentine botanist.) — MICHELIA.

About 45 species of tropical and warm-temperate climates of southeastern Asia, India, and Ceylon. One species more commonly encountered in warmer areas of North America is precariously hardy in the southern part of our range, while *Michelia doltsopa* Buch.-Ham. ex DC., of western Yunnan, Tibet, and the eastern Himalayan region, and *M. compressa* (Maxim.) Sarg., of Japan, the Ryukyu Islands, and Taiwan, are sometimes grown in warmer regions of the United States. The flowers

of *M. champaca*, a large tree native to India, are the source of champaca oil, which is widely used in India as a perfume.

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1. *M. figo* (Loureiro) Sprengel in Linnaeus, Syst. Veg. ed. 16. 2: 643. 1825.

Bushy evergreen shrubs to ca. 6 m.; new growth covered with a copper-colored pubescence, the young branchlets rufous-tomentose, older branchlets with finely fissured, grayish-brown bark. Petioles short, (1-) 2-4 mm. long, finely rufous-pubescent; leaf blades thinly coriaceous, 3-8(-10) cm. long, 2-3.5(-4) cm. wide, elliptic to oblanceolate or obovate, usually constricted distally, tapering to the rounded or blunted apices, the bases cuneate; upper surfaces of the blades bright glossy green, the lower surfaces dull green, with prominent, often pubescent midveins. Flowers very fragrant, solitary, axillary, on short, pubescent pedicels, in bud enclosed by a single rufous-pubescent stipular bud scale; tepals 6, subsimilar, creamy white, yellowish, often tinged brownish-purple, oblong-ovate, 1.8-2.5 cm. long; stamens 7-10 mm. long, the connectives produced into obsolete acute appendages or the appendages absent; gynoecia distinctly stipitate, the gynophore and 2-ovulate carpels pubescent. Fruit aggregates 2-4 cm. long, cylindric, usually asymmetrical from seed abortion, the individual follicles free, dehiscing widely, the valves with short styler beaks; seeds 2 per follicle, subglobose to globose, 8-10 mm. long, the outer seed coats red. $2n = 38$. (*Liriodendron figo* Lour.; *Magnolia fuscata* Andr.; *Liriopsis fuscata* (Andr.) Spach; *Michelia fuscata* (Andr.) Wall.) — BANANA-SHRUB.

Native to southeastern China; known to be cultivated in our area at Colonial Williamsburg, Virginia.

Tribe LIRIODENDREAE Reichenbach

3. *Liriodendron* Linnaeus, Sp. Pl. 1: 535. 1753;
Gen. Pl. ed. 5. 239. 1754, "*Liriodendrum*." ⁶

Deciduous trees of sympodial growth, the grayish bark becoming fissured into longitudinal platelets; young branchlets with septate pith; winter buds obovoid, enclosed by 2 coherent stipules, the terminal buds often mixed, containing a terminal flower primordium subtended by one or more axillary buds. Leaves alternate, long-petiolate, stipulate, the stipules free from the petioles, large and conspicuous, caducous, leaving annular scars at the nodes; leaf blades usually with a truncate or widely emarginate apex and 1 or 2 lateral lobes on each side near the base. Flowers odorless, appearing with the leaves, terminal, solitary. Perianth of 9 segments, 3 reflexed sepals forming the outer whorl, the inner 6 petals in 2 whorls of 3, simulating a campanulate or tuliplike corolla. Stamens numerous, spirally arranged, with stout filaments, the linear anther sacs extrorsely dehiscent, the connectives produced into apiculate appendages. Gynoecia sessile, of numerous spirally arranged, 2-ovulate carpels densely imbricated on an elongate axis; styles elongate, broad and flattened, constricted terminally into a small, $\pm$ recurved stigma. Fruit a spindle-shaped, brown, conelike aggregate of free, tightly imbricated, 2-seeded samaras deciduous at maturity, the floral axis persistent. Seeds small, with a thin, dry, seed coat; embryo embedded in endosperm. (*Tulipifera* Miller.) TYPE SPECIES: *L. tulipifera* L. (Name from Greek *lirion*, lily, and *dendron*, tree, in reference to the lily- or tuliplike flowers.)

Two species, one of eastern North America, the second of China and northern Indochina. Fossils indicate that the genus was widely distributed in temperate regions of the Northern Hemisphere during the Tertiary period. Recently, hybrids between the two species have been obtained as the results of intentional cross-pollinations (see F. S. Santamour, Jr., 1971, 1972).

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⁶This treatment of *Liriodendron* has been prepared in collaboration with N. G. Miller, Arnold Arboretum and Gray Herbarium, Harvard University.

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KEY TO THE SPECIES OF LIRIODENDRON

1. Petals 4-6 cm. long, with an irregular orange band near the base on both surfaces; gynoecium included within the perianth following anthesis. 1. *L. tulipifera*.
1. Petals 2-4 cm. long, green with yellow veins on the abaxial surface; gynoecium exserted from the perianth following anthesis. 2. *L. chinense*.

1. *L. tulipifera* Linnaeus, Sp. Pl. 1: 535. 1753. FIGURE 6, h-s.

Large trees to 50 m. or rarely to 60 m., the bark becoming deeply furrowed; branchlets $\pm$ stout, glabrous, brittle, reddish-brown and often $\pm$ glaucous, becoming grayish, the periderm exfoliating in thin sheets. Petioles 5-10 cm. long, the large caducous stipules up to 3.5 cm. long; leaf blades becoming golden yellow in fall, variable in outline, 7-12 cm. long, usually saddle-shaped, with 2 pairs of lateral lobes near the base and with 2 lobes distally, creating a $\pm$ truncate or shallowly emarginate apex, the lobes usually $\pm$ rounded, the juvenile leaf blades deeply lobed half-way or more to the middle; upper surfaces of the leaf blades bright green, the lower pale green, faintly glaucescent. Flowers $\pm$ tulip-shaped, the 3 outer sepals greenish, strongly reflexed, the inner 6 petals $\pm$ erect, 4-6 cm. long, 1.8-3 cm. wide, pale green, with an orange-colored band near the base, the color strongest on the adaxial surfaces; stamens numerous, usually included; filaments 10-15 mm. long, the anther sacs 15-25 mm. long; gynoecia mostly included, the carpels numerous, pale yellowish-green at anthesis. Fruit aggregates to 7 cm. long, the samaras light brown, ca. 5 mm. wide, to 4.5 cm. long, with acute apices, the lowermost samaras often persistent on the floral axis through winter. $2n = 38$. — TULIP-TREE, YELLOW-POPLAR, TULIP-POPLAR.



FIGURE 6. *Liriodendron*. a-g, *L. chinense*: a, habit of flowering branchlet, $\times \frac{3}{4}$; b, petal, $\times \frac{1}{2}$; c, abaxial view of stamen showing extrorse lines of anther sac dehiscence, $\times 1\frac{1}{2}$; d, samara, $\times 1$; e, seeds as positioned in samara, $\times 3$; f, outline of typical leaf, $\times \frac{1}{4}$; g, outline of juvenile leaf, $\times \frac{1}{6}$. h-s, *L. tulipifera*: h, habit of flowering branchlet, $\times \frac{1}{2}$; i, petal showing band of orange pigmentation, $\times \frac{1}{2}$; j, abaxial view of stamen, $\times 1\frac{1}{2}$; k, flower with perianth

Native to the deciduous forests of eastern North America from Massachusetts, Vermont, and southern Ontario southward to eastern Missouri, Arkansas, Louisiana, and Florida. (See E. L. Little, Jr., Atlas U. S. Trees 1: Map 137-E. 1971.)

Numerous variants of *Liriodendron tulipifera* have been recognized in cultivation. Several variants which probably occur sporadically in nature have also been given botanical names at the rank of variety or forma. Most, however, have subsequently been treated as cultivars, and they are listed as such below. However, should reference to these variants in a botanical context be preferred or necessary, the equivalent botanical names are given in parentheses. Among the variants are 'Aureomarginatum' (= *L. tulipifera* f. *aureomarginatum* Hort. ex Schelle in Beissner *et al.*, Laubh.-Ben. 101. 1903), plants with the leaf blades edged yellow or greenish-yellow; 'Fastigiatum' (= *L. tulipifera* var. *fastigiatum* H. Jäger in Jäger & Beissner, Ziergeh. ed. 2. 203. 1884; *L. tulipifera* f. *fastigiatum* Schelle ex Schwerin, Mitt. Deutsch. Dendr. Ges. 1919: 140. 1919; *L. tulipifera* f. *fastigiatum* Schelle, nomen nudum), erect trees of columnar habit; 'Integrifolium' (= *L. tulipifera* f. *integrifolium* Kirchner in Petzold & Kirchner, Arb. Muscav. 118. 1864, without indication of rank; rank assigned by Schwerin, Mitt. Deutsch. Dendr. Ges. 1919: 140. 1919), plants with the leaf blades lacking lower, lateral lobes; and 'Obtusilobum' (= *L. tulipifera* var. *obtusilobum* Michx., Fl. Bor.-Am. 1: 326. 1803; *L. tulipifera* f. *obtusilobum* (Michx.) Schelle in Beissner *et al.*, Handb. Laubh.-Ben. 101. 1903), plants having leaf blades with one rounded lobe at each side near the base. Additional cultivars of *L. tulipifera* are listed and described in Bean (1973, p. 586) and Krüssmann (1960, p. 63).

2. *L. chinense* (Hemsley) Sargent, Trees & Shrubs 1: 103. t. 52. 1903.

FIGURE 6, a-g.

Trees to ca. 16 m., similar in structure and appearance to *Liriodendron tulipifera* but apparently not attaining the size of that species. Petioles 7–18 cm. long, the caducous stipules to 3.5 cm. long; leaf blades variable in outline, usually saddle-shaped, with 1 pair of lateral lobes near the base and with 2 lobes distally, creating a $\pm$ truncate or shallowly emarginate apex, the lobes usually drawn out and $\pm$ apiculate, the juvenile leaf blades deeply lobed halfway or more to the middle, the lobes not apiculate; upper surfaces of the blades dark green, the lower surfaces glaucescent. Flowers $\pm$ cup-shaped, the 3 outer sepals greenish, reflexed, the 6 inner petals $\pm$ erect, 3–4 cm. long, glaucescent and green on the abaxial surfaces, green with yellow veins on the adaxial surfaces; stamens nu-

and stamens removed to show gynoecium, $\times \frac{1}{2}$; l, detail of apex of carpel showing stigma, $\times 6$; m, conelike aggregate of samaras, $\times \frac{1}{2}$; n, samara, $\times 1$; o, seeds as positioned in samara, $\times 3$; p, q, r, outlines of leaves showing variation in shape, $\times \frac{1}{4}$; s, outline of juvenile leaf, $\times \frac{1}{8}$.

merous, about as long as the tepals, the filaments 5–7 mm. long, the anther sacs 10–16 mm. long; gynoecia exserted at anthesis, the carpels numerous, yellowish-green. Fruit aggregates to 9 cm. long, the light brown samaras ca. 6 mm. wide, to 4 cm. long, the outer (lower) samaras usually with acute apices, the inner (upper) samaras with acute or usually obtuse apices. $2n = 38$. (*L. tulipifera* var. ? *chinense* Hemsley; *L. tulipifera* var. *sinensis* Diels.) — CHINESE TULIP-TREE.

Native to China and Indochina. Recent distribution records (see C. Y. Wu & W. T. Wang, *Acta Phytotax. Sinica* 6: 183–254. *pls.* 45–50. 1957) indicate its occurrence in Anhwei, Kiangsi, Fukien, Hupeh, Szechwan, Kweichow, Kwangsi, and Yunnan provinces, China, and in Chapa, Vietnam.

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